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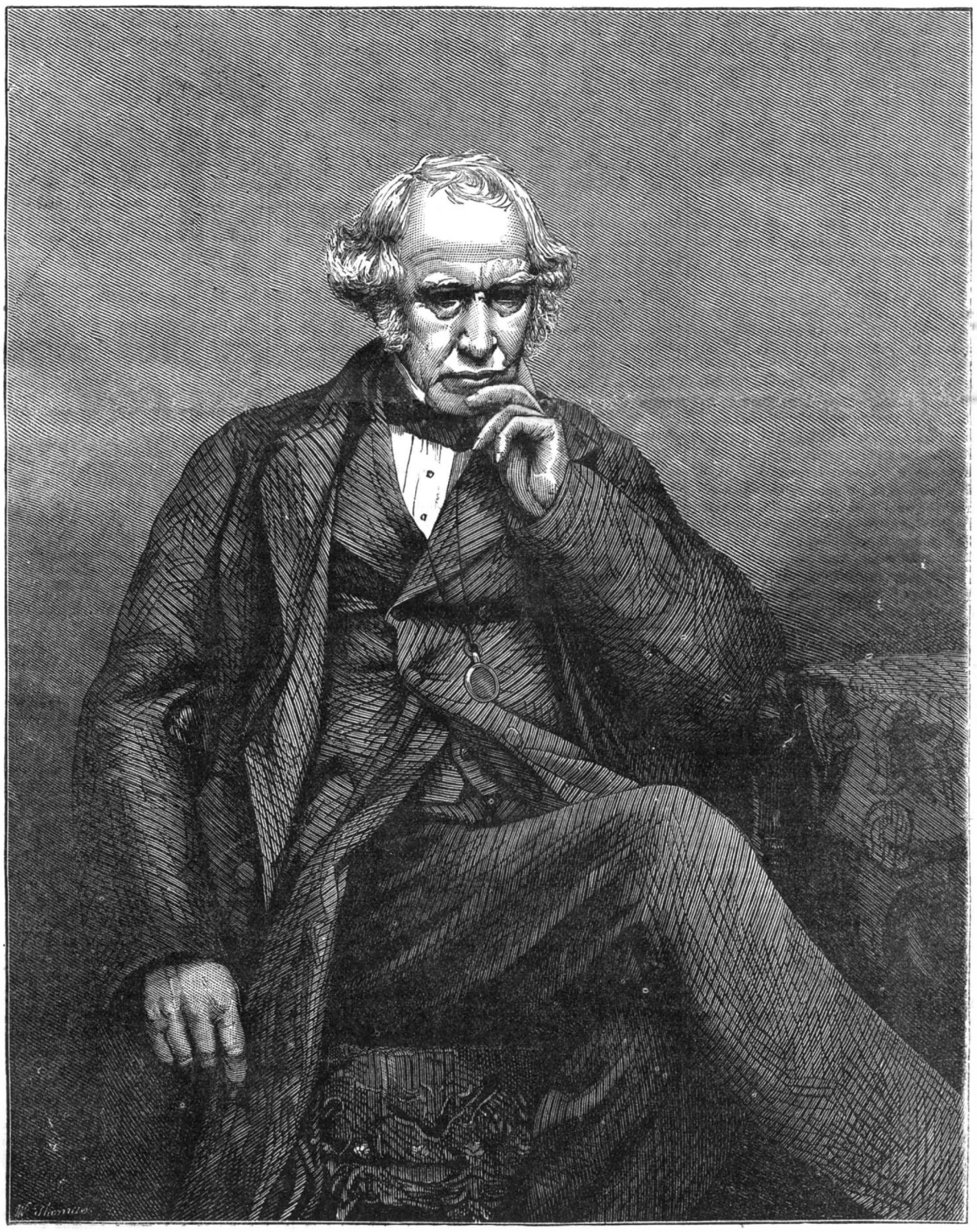
SIR WILLIAM FAIRBAIRN.

Sir William Fairbairn, the distinguished English engineer, whose portrait we give herewith, died on the 18th of August last, at the advanced age of 85 years. One of the first to undertake the construction of iron vessels in England, thus aiding in founding a manufacture in which that country has, until lately, maintained an unrivaled supremacy, the first to substitute iron for wood as shafting for cotton mills, the inventor of the riveting machine, the author of experiments and works which have changed the whole practice of iron construction: to few men do the engineering profession and the great metal industries of the world owe so large a debt.

The record of the long and useful life, now closed, shows, during early years, that persevering struggle against limited means and humble birth, which has characterized the initial efforts of many of the most famous men. Born in the year 1789, at Kelso, on the Tweed, his sole education consisted of such rudiments as were taught at the parish school. With a knowledge of writing and arithmetic which is described as "imperfect," he entered upon an apprenticeship as an engine wright, in the Percy Main Colliery, and when his time had expired worked for two years in London as a journeyman. Travel in those days was a necessary part of every workman's education, and Fairbairn availed himself of opportunities to visit various portions of the kingdom, working a short time at every place, and, while not neglecting his books, posting himself thoroughly in every particular of the practical portion of his trade.

About the year 1817, we find him settled in Manchester in partnership with Mr. Lillie, founding a firm which steadily progressed and became known as the leading machine makers of the city. From this period, it appears, date the investigations and inventions which eventually rendered their author one of the greatest of modern engineers. With the limited space at our disposal, it is impossible to review all these works in detail, nor is it necessary, since the published reports of the English scientific societies of the period and Fairbairn's own volumes contain the full descriptions. One of his earliest inventions was that, already alluded to, of substituting iron for wood as shafting in cotton mills, and the introduction of lighter and improved machinery in factories, more simple than the contrivances then in use. These modifications resulted not only in the reduction of the cost of machinery, but allowed of speeding the same from 40 to 160 revolutions per minute. Then followed the introduction of



Yours faithfully
W. Fairbairn

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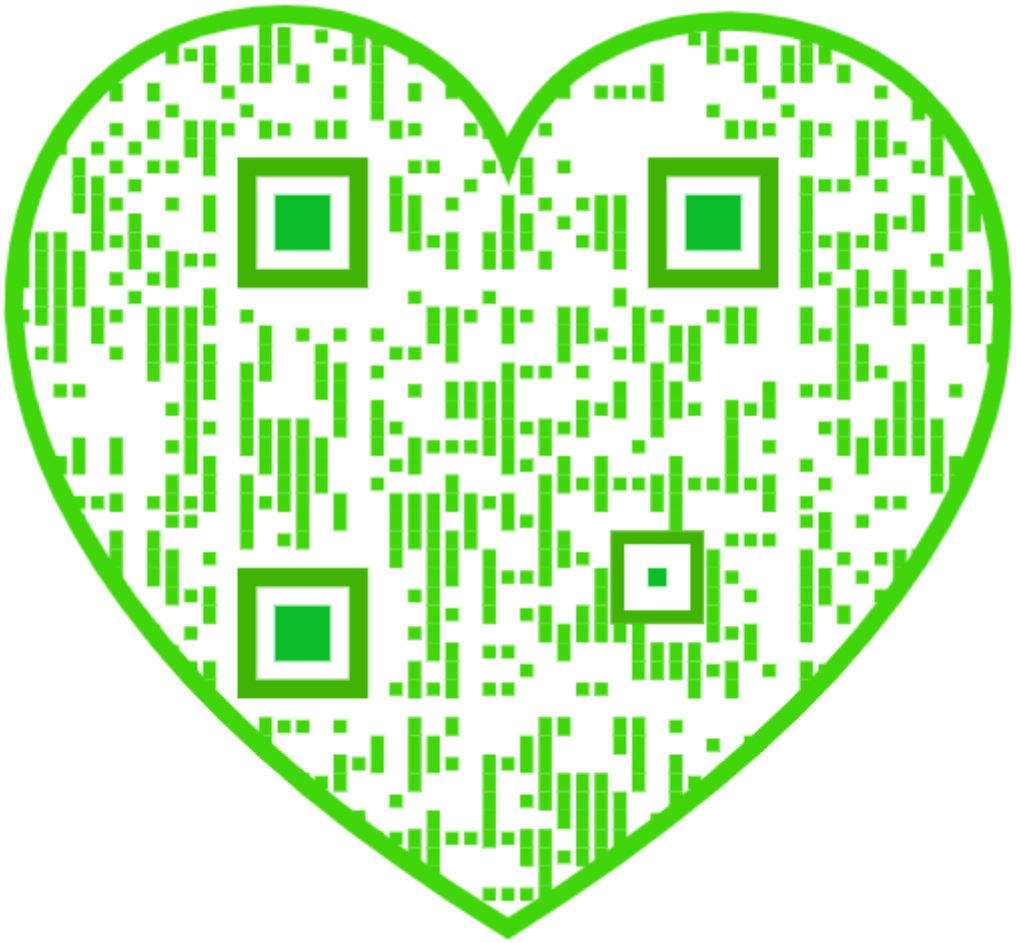

a double flued boiler for alternate firing, productive of economy of fuel and consumption of smoke, improvements of feeding apparatus in millstones, the adoption of a better principle of suspension and the use of ventilated buckets in water wheels, the invention of the riveting machine, and, finally, in 1836, the introduction of improved architecture for factories.

Experiments upon canal boats engaged Fairbairn's attention in about the year 1821, and through these researches he was led to examine the advantages of iron for the construction of vessels. One of his earliest attempts was the building of a small iron ship, which was set up at his works and carted through the streets of Manchester to the water. His experiments thus begun resulted, five years later, in his development of iron construction in ships of the largest class, at Millwall, London, on the premises afterward occupied by Mr. Scott Russell. Here more than one hundred vessels were built by Fairbairn's firm, ranging from frigates to small boats. It is to Fairbairn that we owe the repeated enforcement of the fact that a ship is, in many respects, to be regarded as a huge beam or girder.

In conjunction with Mr. E. Hodgkinson, the subject of our sketch conducted a series of experiments, resulting in the determination of the comparative strengths of hot and cold blast iron, of the tenacity of boiler plates of various thicknesses, of the best form of section of cast iron beams, of the resistance of hollow tubes to outside pressure, and also in the general use of wrought iron plate girders in ordinary building operations. One of the first edifices ever constructed of iron was a corn mill, manufactured in 1838 by Fairbairn, the castings, etc., of which were sent to Constantinople, where it is still standing.

Mr. Fairbairn's experiments on tubes were conducted during the erection of the celebrated tubular bridge over Menai Straits; and although considerable controversy was engendered at the time, the original plans of Robert Stephenson were modified in accordance with the results. Stephenson suggested a circular tube supported by chains, but Fairbairn found that a rectangular structure, strengthened by a series of cells at the top and the bottom, and suspenped, without supports, from pier to pier, was best adapted to the stipulated conditions.

Subsequently to this period, Mr. Fairbairn made researches into the strength of wrought iron plates and rivets for shipbuilding, and also into boiler explosions. He believed that steam could be worked with greater economy at a pressure of from 150 to 200 lbs. per square inch, and that at a high rate of expansion, with two or more cylinders. With this view he first constructed the Lancashire boiler, and subsequently, in 1872, a fire tube boiler, which was tested safely to 400 lbs. per square inch, and found to stand uniformly the first mentioned high pressure.

Mr. Fairbairn was one of the founders and afterwards President of the British Association. His published works, besides a large number of papers on special subjects, are: "Iron, Its History and Manufacture," "Mills and Mill Work," "Application of Iron to Building Purposes," "Iron Ship Building," and three series of "Useful Information for Engineers," all standard volumes of reference. He was a corresponding member of the Institute of France, a Chevalier of the Legion of Honor, and a Baronet, the last named honor being conferred upon him in 1869.

NEW INDUSTRIAL RESOURCES OF FRENCH COLONIES.

A French commission has recently carried on extensive investigations into the resources of the colonies of France, with a view of determining as to whether certain indigenous productions can be utilized for industrial purposes. From the results elicited, it appears that active measures will be taken for the introduction of some products and for the cultivation of others. Special attention is to be given in the Réunion Islands to the cultivation of vanilla. Plantations are established, which will be renewed every ten years, and are designed solely for the propagation of healthy slips for distribution, it being hoped that, by this means, the gradual disappearance of healthy plants may be checked.

The Tahiti Islands furnish the finest variety of mother of pearl now known; but commerce therein is at present carried on by English and German merchants. French government officials have been supplied with funds, and efforts will, through them, be made to establish a French trade, both in this substance and in tortoiseshell. Ramie is found in large quantities in Tahiti, but is too costly a production to figure in commerce. Another variety, also adapted to textile manufacture, has been recognized in the Antilles and in French Guiana. The crop averages about 3,420 pounds to the acre, the white fibers being some 6 feet in length, and worth 18 cents per pound. This yield per acre is superior to that of sugar. The sap of the *balata minusops*, or Guiana gutta percha tree, was rejected, in 1867, as valueless, on account of the friable properties of the resulting product, and the resinous effervescence which appeared thereon. Some fragments of the plates employed in the tests have lately again been experimented upon, and the material is now found to possess all the qualities of good gutta percha. The former defects were due to bad preparation. Further investigations into this product will be inaugurated.

The commission has also found a large deposit of valuable fertilizer in the bones of the cod from the fisheries of St. Pierre and Miguélon. The remains are rich in phosphate of lime, and contain 21 per cent of ossein.

JUMPING OF GAS FLAME.—This is caused by water condensing in some low place in the fittings. Have the pipe cut, and a T piece put in, with a small tap, so that water may be let out before turning on the gas.

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THE TORPEDO PRACTICE AT NEWPORT.

The torpedo practice during the recent fleet drill at Key West, it will be remembered, was not exactly of a nature calculated to impress the public mind with a sense of the tremendous destructive force of bags of powder poked out on the ends of sticks; and consequently, since that time, slurs upon our naval torpedo system have been more frequent than commendations for the efforts of the very zealous corps of officers, who, for several years past, have been quietly working and experimenting, at their station on the bleakest of the islands in Newport Harbor. With the publication of the excellent results of the recent trials at Newport, however, the cloud which has obscured the labors of the experimenters is dispersed; and we must admit that, in lieu of sticks and powder sacks, the torpedo officers, Professor Moses Farmer and Lieutenant John P. Merrell, have developed for us a means of warfare of terrible efficiency.

The recent trials took place on successive days, in the presence of a congressional committee, and a large concourse of spectators. The initial experiment was the explosion of a ground torpedo of fifty pounds of powder enclosed in an iron-cased shell. This was blown up by Professor Farmer's dynamo-electric machine. Two fifty pound torpedoes were then fired by the contact of a boat with the circuit closers; and the blowing up of apparatus improvised from ordinary water breakers followed, to show how easily these destructive weapons could be constructed from the simplest materials, and without special machinery.

The plane table was used in the explosion of a three hundred pound torpedo, the current being established at the instant the approaching vessel was seen through properly adjusted sights. A column of water, two hundred feet high, marked the tremendous violence of the escaping gases. An attempt was made to blow up an old hulk, by the aid of submarine torpedoes; but through some mal adjustment of the latter, the vessel, though badly damaged, was not destroyed. An excellent feature of the operation was, the firing of a torpedo through a mile of cable, the main object being to show that this means of offense or defense could be safely carried on beyond the range of the enemy's fire. An explosion of 500 igniters simultaneously, proving that several mines could readily be blown up at once, concluded the experiments of the first day.

An old coal schooner formed the objective point of the second day's operations, the interest of which was greatly hightened by the participation therein of the new ironclad torpedo boat Intrepid. This vessel is a small steamer, built expressly for torpedo manœuvering. She steams at a rate of about nine knots per hour. The hulk being stationed out in the stream, the Intrepid backed astern for about a mile in order to get good way on, and then rushed ahead at full speed. The Harvey torpedo, which she towed on her starboard side, was brought in contact with the hulk and, at the instant of touching, fired by an electric fuse, smashing in a huge hole in the vessel's side. Immediately the Intrepid dashed up for a second trial, and this time exploded a spar torpedo, rigged out from her port side, directly under the bottom of the fated craft. A fearful explosion, followed by the hurling aloft of great fragments of wood and masses of water, showed that the weapon had done its work. The ship was literally torn to pieces, leaving but a few large portions drifting about. A second torpedo blew these out of existence, and the total disappearance of hulk marked the close of, probably, the most successful extended series of torpedo experiments conducted under naval auspices in this country.

RECENT METALLURGICAL RESEARCHES.

Some facts of interest to metallurgists, in gold and silver, are to be found in a recent memorandum of Mr. Chandler Roberts, chemist to the British Mint. We learn that the spectroscopic assays, begun last year, have been successfully prosecuted, giving results that prove that, for purposes of quantitative analysis, the spectroscope must form an auxiliary of the highest value. It is stated that differences of composition amounting to less than $\frac{1}{10000}$ part may thus be determined.

Mr. Roberts quotes the interesting results obtained by M. Serol, of the Paris Mint. This chemist finds that, while a silver copper alloy containing 71·893 per cent of the former metal is homogeneous, in all alloys containing more silver than this amount the center of the solidified mass is richer than the interior. A mass of 112 ozs. of silver copper alloy, melted, carefully stirred, and allowed to solidify, was found not to be homogeneous. The silver accumulated at several points, not bearing any apparent relation to the geometrical form of the mass. A homogeneous plate was at last obtained by assaying all parts of a plate of standard silver and cutting off those portions which varied from the required standard. Perfectly pure gold was obtained by reducing the chloride of gold with oxalic acid and fusing in a clay crucible with bisulphate of potash and borax. The electrolysis of cyanide of gold and potassium gave a product containing 999·9 of fine gold in 1,000, while reduction of the chloride with sulphate of iron and subsequent fusion gave only 999 85.

PROTECTION FROM LIGHTNING.

During a recent thunderstorm in the village of Trumbull, Conn., a family of three persons, husband, wife and child, who had taken refuge on a feather bed, were instantly killed by lightning; the house had no rods. In the same village, during the same storm, a dwelling house, which had two lightning rods upon it, was seriously damaged. Several of our readers, who have seen the accounts of these disasters, and others who cite analagous examples, have had their faith in feather beds, as a place of safety during thunder storms, severely shaken; while some of them would fain believe that lightning rods serve to destroy rather than to preserve life and property. We are asked to print something upon the subject; and we cheerfully comply, premising, however, that there is little that is new to be said, and that the subjoined information has for the most part been heretofore reiterated in our columns.

ARE FEATHER BEDS A PROTECTION FROM LIGHTNING?

Feather beds are not a protection from lightning, and the popular belief that they are, doubtless results from a misapprehension of the laws that govern the passage of electricity. The human body is a better conductor of electricity than feather beds or other objects ordinarily contained in the apartments of dwellings, and therefore, *a priori*, when the lightning enters an apartment, the human body is likely to form one in a chain of inductions, determining the path of an electrical discharge, unless better conductors are in its vicinity to divert this action.

WHAT IS THE SAFEST PLACE DURING A THUNDERSTORM?

The only place of absolute security in a thunderstorm is an iron building; or next in safety is a building properly protected by lightning rods.

Houses constructed entirely of iron manifestly stand in no need of lightning rods at all, because the electric fluid, on striking so good a conductor, would rapidly diffuse itself in all directions and flow into the ground, provided, of course, that the construction of the building is such as to allow its free escape.

ARE LIGHTNING RODS OF ANY REAL VALUE?

Unquestionably they are. Examples are numberless where the lightning has been seen to fall upon the rods of buildings and descend harmlessly to the earth; while the fact is undisputed that the principal damages suffered from lightning are in connection with buildings that are not provided with conductors. Notwithstanding these facts, some people are apt to be indifferent whether their houses and stores are provided with lightning rods or not, and are always ready to give an example where some building so provided was struck in spite of its protection. Such cases are quoted by the old fashioned "practical men" with much satisfaction, because they hail in them what they are pleased to call the victory of their sound common sense and the discomfiture of the scientific man. This class is, however, rapidly diminishing in numbers under the influence of the extensive diffusion of scientific education among the people.

It may be well to assure unbelievers that the efficacy of the lightning rod is no longer an open question, and that any

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failures are attributable *to bungling or ignorant construction.* It would be an easy matter to multiply statistics in proof of the assertion; but none would carry with them more force than the following statement obtained from the records of the British navy, by Sir Snow Harris, F. R. S :

"Between 1810 and 1825, before rods were introduced, no less than thirty-five sail of the line and thirty five frigates and smaller vessels were completely disabled; and in 200 cases recorded, 300 seamen were either killed or injured. When the lightning rod was introduced, every mast was furnished with a capacious conductor permanently fixed and connected with bands of copper passing through the sides of the ship under the deck beams, and with large bolts leading through the keel and keelson, and including, by other connections, all the principal metallic masses employed in the construction of the hull" (Harris). Since the adoption of this arrangement, "it appears that damage by lightning has positively vanished from the records of the navy."

In England, the various telegraph companies suffered serious damages by every thunderstorm, by the destruction by lightning of their poles. The poles are now provided with small lightning rods, and all damage has ceased.

In this country the Western Union Telegraph Company has suffered in the same manner, especially, says a recent number of the *Journal of the Telegraph*, "upon the plains and prairies, where every lightning storm formerly shattered and destroyed more or less of our poles, but which are now fully protected by a conductor (No. 8 wire) placed on every fifth pole. Wherever telegraph poles are provided with such lightning rods, all damage is prevented. Where the poles are not provided with rods, damage ensues.

WHAT IS THE PROPER SIZE AND MATERIAL FOR HOUSE LIGHTNING RODS?

According to the best authorities, a copper rod of one inch in diameter, or an equal quantity of copper under any other form, will resist the effect of any discharge of lightning hitherto experienced. The copper rod is therefore the safest and best material that can be used, but it is expensive. Iron rods of one inch in diameter are very commonly used, and, if pointed with solid copper and properly put up, are efficacious in the great majority of cases. The particular form of the rod makes no difference. It may be round or square, twisted or hollow, composed of one solid piece or made of wires twisted together. It is the quantity of metal contained in the cross section of the rod that is of value, not the form.

WHY SHOULD THE ROD BE POINTED?

The reason for terminating lightning rods in a point is as follows: When a thunder cloud highly charged with positive electricity comes up, it repels the positive electricity of all bodies on the surface of the earth coming within its influence, and causes negative electricity to accumulate in them. This is called induction, and it always takes place before a discharge. Now it has been discovered that, when electricity is accumulated in a body in this manner, it can most readily escape by sharp points because in them it meets with the least resistance. A lighted candle held near the prime conductor of an electrical machine furnished with a point will be nearly blown out by the current of air produced by the escape of the electricity. Lightning rods are therefore provided with sharp points to allow the accumulated negative fluid to pass off readily into the air and neutralize the positive fluid of the thunder cloud.

HOW SHOULD RODS BE MADE AND APPLIED?

The object being to make so good a passage for the lightning to the ground as to remove all danger of its leaping to some conductor in the house, the greatest care must be taken not to have any break in the conductivity. As it is inconvenient to manufacture or transport the rods in one piece, the different parts must be in intimate connection when they are put up; it is best to have them soldered and the joints protected from the air and moisture.

The point of the rod should be extended a little above the chimney or highest part of the building, and should be fastened in contact with the building by staples or cleats. Glass insulators should not be employed. It makes no difference in conductivity whether the rod is painted or not painted.

No building can be said to be properly rodded or protected against lightning, unless the lower part of the rod or terminal under the ground is made quite extensive. The extremity of the rod should connect with masses of good conducting materials, such as old iron, or iron ore, or coke, or charcoal, laid in trenches, or the rod itself should be elongated, sunk deep in the ground, and carried a considerable distance from the building, and put in connection with water or moist earth if possible. The golden rule for safety is: "Provide the largest possible area of conducting surface for the terminal of the rod."

LOOK TO YOUR TERMINALS.

A lightning rod which is not properly connected with the earth is quite dangerous. The very common method of merely sticking the lower end of the rod down into the dry earth near the surface of the ground is bad, and endangers the building, because dry earth is such a poor conductor, and the amount of rod surface in contact with the earth is so small. Under such conditions, a portion of the electric current will be likely to find an easier path to the earth, through the building than through the rod; and a part of the electricity will therefore leave the rod, strike into the building, and down in various directions into the earth, making havoc as it goes. As a measure of prudence, house owners should *look to the terminals* of their lightning rods, and place there a considerable amount of the conducting materials above named.

By adopting this simple expedient, many buildings, otherwise unsafe, will be rendered comparatively secure from damage by lightning.

As an electrical conductor, well burnt charcoal ranks next to the metals. Metallic ores come next to charcoal. Water and moist earth, which are so frequently recommended as terminals for lightning rods, are among the poorest of conductors.

One of the best protected buildings that we have heard of is that of Mr. John Knox Smith, an intelligent English merchant residing at Singapore. His country house is built on a prominence, upon a bed of iron ore, with which the house lightning rods are made to communicate. The lower ends of the rods thus have a very extensive conducting surface, and the protection afforded is considered perfect. Thunder storms and lightning strokes are very frequent, but the house has never been injured.

PROTECTIVE AREA OF RODS.

It was supposed to have been established by Charles and Gay Lussac that a lightning rod protected an area whose radius was double the hight of the rod extending above the building, but this rule is no longer reliable by reason of the extensive use of metals in the shape of pipes, etc., in the construction of the buildings of our day.

WATER AND GAS PIPES SHOULD BE CONNECTED WITH THE LIGHTNING ROD.

When electricity finds several paths to the ground, it will prefer the best, it is true; but some portion will also pass along the poorer conductors. If, therefore, any metallic substances lie within the area supposed to be protected, they are in danger of being struck. This is especially true where the lightning has a chance to jump to the gas and water pipes of a building. It is a good plan to connect these pipes with the lightning rod; if the rod is struck, the electricity will then have an excellent path into the ground and will be rapidly diffused over the vast underground network of pipes. The danger to the inmates of the house of being struck from these pipes is less than that of receiving a shock from the powerful induced currents, liable to be developed in them, if unconnected, during a thunderstorm.

IS MORE THAN ONE ROD USEFUL?

The more rods on a building the better, especially if all are connected with each other near their upper ends.

Multiple lightning conductors are useful because each one helps the others, and if the discharge is too great for one, they will be able to carry it between them, but what is more important is this: The less the total resistance of the conductor to earth, the more certain is it that no other, undesirable line will offer an approximately good path to the earth, and so get a part of the flash. Thus, suppose a single rod whose resistance is 1, and that a series of bolts, hinges, gutters, stove pipes, etc., offers another line (passing perhaps through the walls of the house or the body of its occupant) whose resistance is 2. Now, under these conditions, a flash would be likely to divide itself, and while $\frac{2}{3}$ would go safely down the rod, $\frac{1}{3}$ passing along the other line might burn the house or kill the man. But if two rods were connected, the resistance in this line would be but half, hence $\frac{4}{5}$ would take this road and but $\frac{1}{5}$ tend to go by the other. Again, the less the resistance of any line, the higher the opposite charge developed in it by induction, and hence the greater its attractive influence, leading the discharge to prefer it as a path. This bears upon the importance of connecting all accidental lines of conductors, such as gas and water pipes, with the lightning rods. Insulated, these are opposition lines, soliciting the lightning to come into house and traverse them; connected, they help the rod as we have seen to get and keep the lightning outside.

METAL ROOFS, GUTTERS, LEADERS, AND WATER TANKS SHOULD BE CONNECTED WITH THE LIGHTNING RODS.

Finally, in the way of general advice, we would say: Connect all your lightning rods together, and also to your iron tank, and water, gas, or other pipes, not by separate connections, but so that there is some connection between all, which connection should be *as high up as possible.* If you have a metal roof, connect all rods with it. If the roof is not of metal, then connect your rods together by means of a good sized conductor *running along the ridge of the roof.* Bear in mind that, to carry off the heaviest lightning flash known, a copper rod one inch in diameter is not considered too large; and though of course such flashes are of very rare occurrence, they may come. Hence the great value of uniting your different rods high up.

THE ELECTROMOTOGRAPH---A NEW DISCOVERY IN TELEGRAPHY.

Within the past few days, we have had under examination, in practical operation in our office, a novel electric telegraph apparatus, which presents some very remarkable features, and promises to result in the creation of an entirely new and advantageous system of telegraphy. It is the discovery of Mr. Thomas A. Edison, of Newark, N. J., who is well known as a telegraph engineer of the highest ability, and the inventor of a larger number of electrical devices, probably, than any other person living. His improvements are employed upon all the various telegraph lines in this country.

The present discovery relates to that form of apparatus known as the automatic or chemical telegraph, in which signals are made and recorded by causing the electricity to pass through paper, the latter being saturated with a chemical substance, which changes in color when the current acts. Lines, dots, and dashes are thus produced with great facility. In the ordinary working of this form of telegraph, the electricity is sent over the line wire by a key, in the usual manner, and passes through a pen, stylus, or lever, which has no movement, but simply rests upon the paper, the latter being moved by a weight or clockwork. No magnet and armature are used.

The salient feature in Mr. Edison's present discovery is *the production of motion and of sound by the pen or stylus,* without the intervention of a magnet and armature. By the motion thus produced, he works any of the ordinary forms of telegraph printing or sounding instruments or relays, and is enabled to send messages, by direct transmission over thousands of miles of wire, at the highest speed, without re-writing, delay, or difficulty of any kind. More than this, his apparatus operates in a highly effective manner, under the weakest electric currents, and he is able to receive and transmit messages by currents so weak that the ordinary magnetic instruments fail to operate or even give an indication of the passage of electricity. Thus, when the common instruments stand still, owing to weakness of current, the Edison telegraph will be at work up to its fullest capacity.

The author has baptized his discovery the Electromotograph, which is, perhaps, as good a title as could be adopted.

We subjoin the following original notes by the author, which explain the peculiar principle that lies at the base of his discovery. These notes, we are confident, will be read with very general interest.

To the Editor of the Scientific American:

In my new system of telegraphy, it would seem that power was obtained or that electricity had been passed into a new mode of motion, as with magnetism; but this is only apparent, not real, if I understand it right.

The electricity, acting by electrolysis, changes the nature of the surface of the paper, either by depriving it of some constituent, or the hydrogen, in conjunction with the metal and paper, form substitution compounds, the surfaces of which are smoother than the paper in its natural state, in the manner that the surface of rough paper is made smooth by dipping it into sulphuric acid. The strangest thing connected with this phenomenon, however, is this:

In trying to ascertain what caused the lever to move, whether it was by reducing the lead by hydrogen to a finely divided powder that acted as a lubricant, or whether the nature of the surface of the lead were changed by the absorption of hydrogen, like palladium, or whether the effect were due to the effort of the gases to escape from under the lever: I was led away from these notions by finding that platinum, with sulphate of quinine, will likewise show the movement. It then struck me that the nature of the paper was changed by the electrolysis. To test this, I had a long message received over the Automatic Telegraph wire from Washington (this wire runs in my laboratory at Newark), and recording the same on ordinary chemically prepared paper. The speed with which the message was sent from Washington was about 800 words per minute, and the colorations forming the dots and dashes were rather faint. I then passed the strip into the electromotograph (I use this name for the want of a better one), the colorations being in a direct line with the lead point. On rotation of the drum, and when no coloration was under the lead point, the lever was carried forward by the normal friction of the paper. But the moment a coloration passed under it, the lead point slid upon the paper as upon ice, the friction was greatly reduced, and the lever moved in an opposite direction to the rotating drum.

In this experiment, no battery was connected to the instrument. This proves that electrolysis produces a change in the nature of the paper.

I afterwards found that, if a tin pen were used to receive the message from Washington, although no marks were seen, the paper appearing unchanged, yet, on passing the paper through the instrument, the movement of the lever was more marked than before. Receiving the message with a lead pen did not give so good results, although lead is the best when used, standing at the head of the twelve metals tried. The next is thallium. On paper moistened with aqueous solution of pyrogallic acid, tin is as good as thallium. Of all the solutions yet tested, potassic hydrate has been found to give the most marked results. The second best is sulphate of quinine. Third, rosaniline oxidized and discolored by nitrous acid.

A peculiarity of the quinine solution is that platinum shows an action, and shows it when either oxygen or hydrogen is evolved on its surface. With hydrogen the friction is lessened, as with all other metals; but with oxygen the friction is increased. This is so with all the metals subject to oxidation; but it appeared strange, at first, that it would show with a metal upon which the nascent gases had no effect.

With a lead point and a solution of the disinfectant known as bromo-chloralum, the evolution of hydrogen increases the friction of the paper enormously.

Silver seldom shows a movement with any solution; and when it does, it is very weak.

Sulphuric acid shows least movement with any metal.

It appears to be a matter of indifference as to the character of the metal used for the drum, which acts as one of the decomposing electrodes. Considering that the lever will close a secondary circuit under the great pressure used upon the lever, its sensitiveness to electricity is wonderful. With a delicately constructed machine, moved by clockwork, which I have nearly finished, I have succeeded in obtaining a movement of the lever, sufficient to close the local circuit with a current (through one million ohms, equal to 100,000 miles of telegraph wire), which was insufficient to discolor paper moistened with potassic iodide, or move an ordinary galvanometer needle. Messages may be read from the sound of the lever, when the most delicate telegraph magnet shows no current.

The uses of this instrument are many; in fact, it gives an entire new system of telegraphy.

As no secondary currents are generated, as with an electromagnet, to prevent the instant magnetization or demagnetization of the iron cores, and electrolysis being instantaneous, it is obvious that the lever will respond to signals transmitted with great rapidity. I have succeeded in transferring signals from one circuit to another at the rate of 650 words per minute; hence it may be used to repeat the rapid signals of the automatic telegraph into secondary circuits.

By attaching an ink wheel to the extremity of the lever, opposite a continuous strip of paper moved by clockwork, messages transmitted at a speed of several hundred words per minute may be recorded in ink. By attaching a local circuit to the repeating points, and adding thereto a sounder, it may be used as a Morse relay to work long lines of telegraph.

T. A. EDISON.

Newark, N. J., August, 1874.

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THE TRANSFUSION OF BLOOD.

The idea of returning to an animal blood which has been lost, or, rather, of replacing the vital fluid which has disappeared through the effects of increasing age or the ravages of illness, by transfusion from the veins of another animal in full health, was known to the ancients. It is described in the "Metamorphoses" of Ovid, and repeatedly alluded to in the works of the old alchemists, who believed that, by such means, perpetual regeneration of the body might be accomplished. Toward the middle of the seventeenth century, the subject appears to have enlisted the attention of French physicians and philosophers; and in the month of June, 1667, experiments, which previously had been frequently practised successfully upon the lower animals, were for the first time tried upon man. Eight ounces of the arterial blood of a lamb were injected, by Denis, into the veins of a child. Subsequently calf's blood was transfused into the blood vessels of a maniac, who shortly thereafter regained his reason. While, starting from these attempts, the operation was again and again repeated, sometimes successful, sometimes the reverse, until it became common in the practice of almost every French physician. Too common, however,—whether through the rude means employed for forcing the fluid into the veins of the patients, or whether from the lack of skill on the part of the operators, or, more probably, a lack of caution on the part of the latter, due to supposed familiarity with all the consequences of the operation—for accidents soon became more frequent than successes. In the course of a few months, failures became the rule and cures the exception; the people became alarmed, and finally, in the beginning of 1668, the Parliament of Paris proscribed the practice, and the fulminations of Rome, closely following, effectually arrested any further investigation and experiment. The physicians, however, carefully preserved and printed their records; and from an old treatise, called the *Clysmatica Nova*, printed in Brandenburg in 1667, we reproduce an engraving showing how, in those days, the operation was performed, Opening a vein and inserting the end of a common syringe constituted the whole process, in marked contrast to the delicately adjusted instruments and careful measurements now employed.

For a century the subject was abandoned, to be taken up again, however, at the lapse of that period, by Harwood, whose researches showed that blood could not be transfused from one animal to another of different families without killing the latter within a few days after the operation. From this discovery date the modern investigations, which have culminated in the acquisition of knowledge sufficient to admit of the safe practice of transfusion of blood from man to man.

The early experiments of Denis, and of others subsequently, would seem to negative the above mentioned truth, but the details of the operations, as handed down, are very defective, and in some instances it is known that individuals, at first benefitted by the transfusion, subsequently died from its effects. There is certain evidence, however, that death was repeatedly caused by transfusion between widely differing animals. More modern experiments, especially those of Prevost and Dumas, prove that the blood of calves or sheep, injected into the veins of a cat or rabbit, is fatal, and mammifers inoculated with the blood of birds rapidly succumb. On the other hand, Lower has shown that the fluid from the veins of one variety of dog acts beneficially upon another dog of different characteristics; and from the experiments of Milne-Edwards and Lafond, of still later date, it appears that it suffices for the two animals to be of the same natural group, although belonging to distinct species. An ass, for example, whose blood was nearly exhausted, was reanimated perfectly by the blood of a horse.

If it is true, then, as facts demonstrate, that, in the case of man or other animal whose life is almost extinct through abundant hemorrhage, revivification may be gained by transfusing a quantity of blood much less than that lost, it becomes an interesting matter to determine to what elements the liquid owes its reanimating properties. Prevost and Dumas show that an injection of serum—that is, blood deprived of fibrin and globules—is utterly without effect. On the other hand, blood containing the globules, but in which the fibrin has been destroyed by agitation, gives strong revivifying results, and hence, as extended investigation has abundantly shown, the perfect globule is absolutely indispensable.

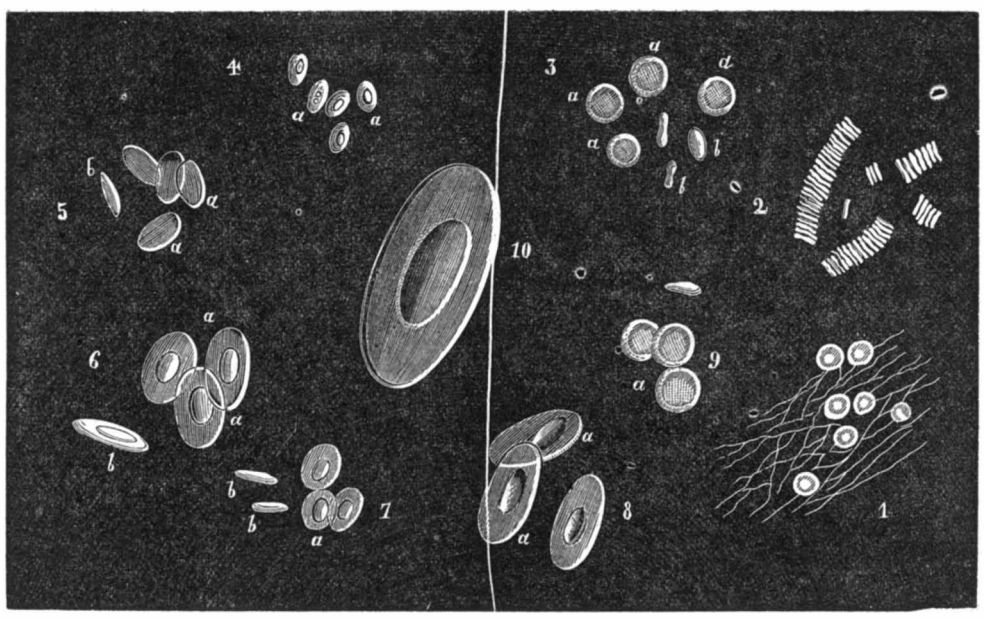
In order to comprehend the hurtful effect of the blood of widely differing creatures, as above alluded to, it is necessary to take into consideration the greatly varying shape of the globules in the blood of various vertebrates. The annexed engraving, representing these globules very much magnified, will, in this regard, be of interest. No. 1 represents human globules imprisoned in the fibrin of coagulated blood. No 2, the same in rolls. No. 3, globules detached, showing them as circular biconcave disks, diameter 0·00026 inch to 0 00017 inch, weight 0 000001 grain, surface 0·000004 inch. No. 4, globules of the camel, elliptical disks, diameter 0·00031 inch. No. 5, globules of pigeon, elliptical, biconvex, diameter 0 0006 inch. No. 6, globules of frog, elliptical, diameter 0·0008 inch. No. 7, globules of cobitis, round, diameter 0·0005 inch. No. 8, globules of water lizard, diameter 0 0015 inch. No. 9, globules of ammocoetis, diameter 0·0004. No. 10, globules of proteus (species of batrachian), diameter 0·0048. *a*, in all the figures indicates front, and *b* side, views.

The results of later investigations prove that the blood of mammifers may be injected into man without producing hurtful effects, so long as the red globules of the animal do not differ greatly in form and dimensions from those in human blood. If the globules become dissolved and soon disappear in the organism into which they are transmitted, they nevertheless produce advantageous though not permanent results. It would seem, then, that, when human blood is unattainable, that of animals may be used.

THE TRANSFUSION OF BLOOD, A. D. 1667.

The mode of performing the operation at the present time is graphically depicted in the large engraving on the opposite page, extracted from a French contemporary. The young woman represented as receiving the blood was a servant, twenty-two years of age, who had become extremely exhausted through hemorrhage and overwork. She was received into the Hospital de la Pitié, in Paris, and the transfusion was accomplished by Dr. Béhier from the arm of Dr. Strauss. The aspirator used was so arranged that by no possibility could any air enter with the blood. The latter was sent into a cup from the veins of the donor and collected in the inferior part of the instrument, whence it was pumped by a small piston worked by a handle. It was then forced through a canula into the veins of the patient. The instrument, in order to prevent coagulation of the fluid, was first immersed in tepid water, and the tubes used were of gold. Before employment, the apparatus was filled with blood, so that considerable of that obtained from the healthy veins was lost. In all about one ounce, out of three, was administered, but this was sufficient to secure restoration to the patient, and to enable her, after a lapse of seven weeks, to resume her ordinary occupation.

The New York *Medical Record*, of recent date, contains an interesting paper on this subject, by Dr. J. W. Howe, visiting surgeon to a charity hospital in this city. He gives an account of his treatment of an invalid woman, forty years of age, whose pulse was weak and irregular, and at times imperceptible. He says: "I abstracted, by means of the aspirator, four ounces of blood from the median basilic of a healthy man. The blood thus obtained was injected into the cephalic vein of the patient. In a few moments she expressed herself as feeling better. There was an immediate and marked improvement in the volume and force of the pulse. This was so perceptible as to be noticed by all present, and prevented me from transferring any more blood. The next morning I found her pulse still improving and her general condition excellent." The patient subsequently regained her strength and recovered.



BLOOD GLOBULES. MAGNIFIED.

Testing Colors for their Fastness.

For this purpose, Professor W. Stein gives the following schedule of directions:

Red.—A small sample of the yarn or fabric is boiled firs in soap water, which should not affect the shade and become but slightly tinged itself; secondly, in lime water, which also should neither affect the shade nor extract it. These tests are sufficient to demonstrate the presence or absence of logwood, sanders, and aniline.

Yellow.—Boil samples successively in water, alcohol, and lime water. Shades which are not fast enough tinge the water and alcohol sensibly, and turn the lime water red. Annatto and turmeric are the most fugitive yellows; fustic is a little faster.

Blue.—1. Boiled in alcohol, a fast blue should not give a red, purple, or blue liquid. 2. Boiled in muriatic acid and water, or alcohol, the liquid should not turn red, nor should the shade on the yarn or fabric change to red or reddish brown.

Purple.—The only fast shades of this class are those derived from combining a vat blue or indigo carmine blue with cochineal, and the madder purple. Boiled with dilute alcohol (one half water), and left to stand ten or fifteen minutes, fast purples suffer no change; nor should they turn brown or reddish brown when boiled with dilute muriatic acid.

Orange.—Boil in water; if it becomes yellow, reddish yellow, or red, the dye is not fast. If the water remains unchanged, boil in alcohol, which should likewise leave a fast orange unaltered.

Green.—Boiled in dilute alcohol, it should not color it blue, green, or yellow; muriatic acid should not be colored red or blue.

Brown.—It is very difficult to test these for their fastness. Boiliug water should not change them to red; when steeped in alcohol they should not become yellow.

Black.—Boiled in water and hydrochloric acid, they should not be yellow.

Prevention of Waste in Manufactures.

In the economy of trade and manufactures, there is nothing more interesting than the prevention of waste, or the discovery of a way by which waste material may be turned to a profitable use. A remarkable case in point has recently occurred. In the manufacture of the beautiful blue and violet dyes that make silken textures and the wearers thereof look so beautiful, there has always been produced a large quantity of dark colored substance, known among chemists as Hofmann's gum. In some aniline dye works the accumulation of this refuse amounts to hundreds of tuns, and has long been a hideous burden. But recently Mr. J. Spiller, a member of the Chemical Society, has discovered that, by the process which chemists describe as destructive distillation blue and violet dyes, quite as good as those extracted in the first instance, can be got out of this gum; and so, as if by magic, the hideous heaps, now lying on the outskirts of many chemical works in England and on the Continent, become as valuable as gold mines, and enterprising chemists reap the reward.

Another instance is reported from Cornwall. The drainage of certain mines there is discharged from a great pit, and flows into the sea. A few enterprizing individuals rented a piece of waste land at the outfall, dug a few catch pits, into which the water poured and threw down a sediment ere it finally escaped. This sediment is ocher, useful for paint and many other purposes, and the quantity collected in this simple way, in one year, was about 2,000 tuns, worth from $2.75 to $5 a tun. These economizers, however, have let some of their profit slip, for a keen contriver dug a pit to intercept their waste water, and in the same year got $1,500 worth of ocher as the reward of his ingenuity,

One more comes to us from Southern Italy, where the people press the oil from olives in common wooden presses, and burn the husks as fuel. A Frenchman from Marseilles went among them, and bought the husks at $4 a tun, and shipped them to France, where, after treating them chemically, he squeezed them in a steam press, and extracted therefrom 20 per cent of oil.—*Chemical Review.*

WATERPROOF PAPER.—A nice article, transparent and impervious to grease, is obtained by soaking good paper in an aqueous solution of shellac in borax. It resembles parchment paper in some respects. If the aqueous solution is colored with aniline colors, very handsome paper for artificial flowers is procured.

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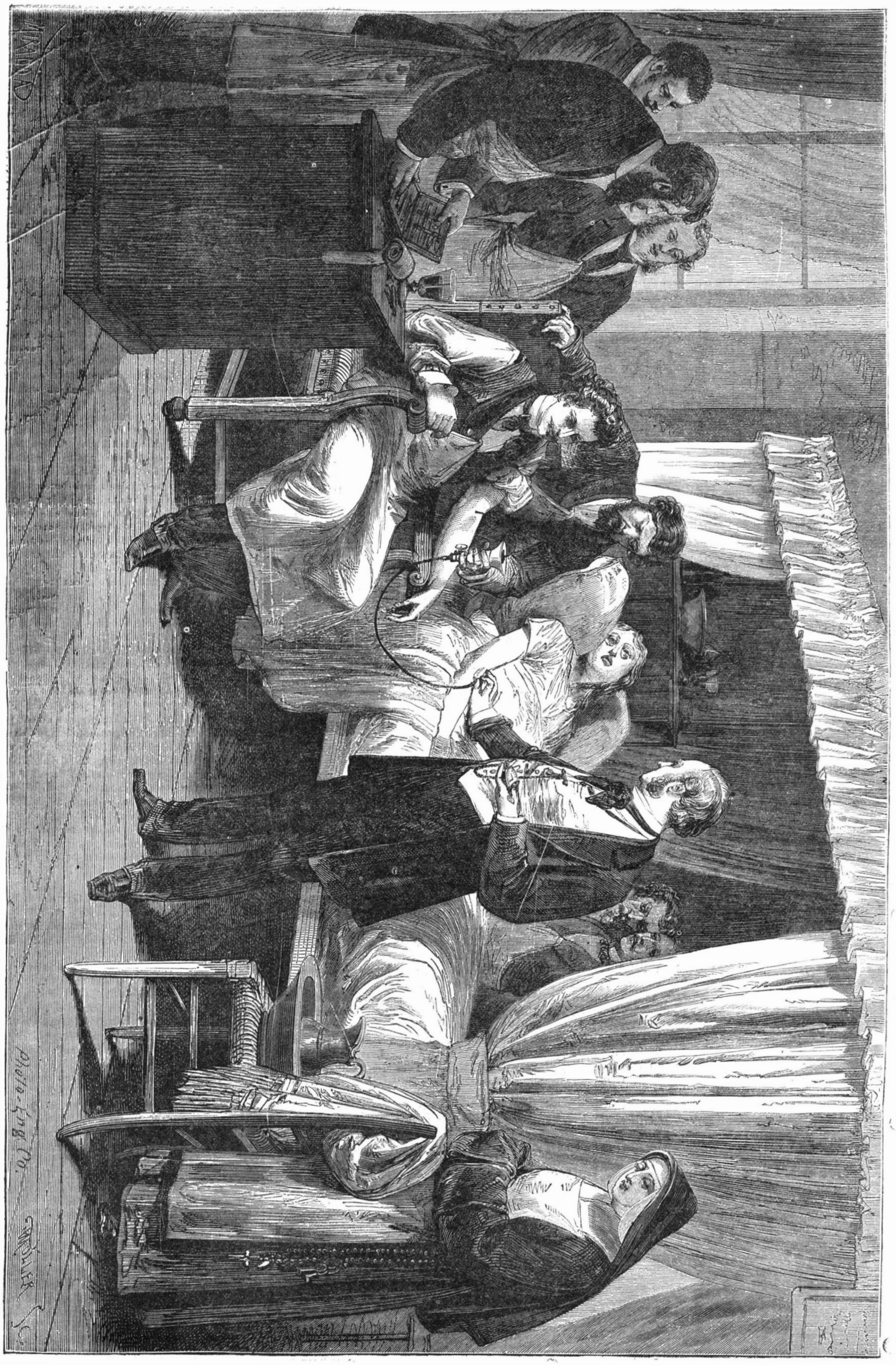

PERFORMING THE OPERATION OF TRANSFUSION OF BLOOD AT THE HOSPITAL OF PITY PARIS FRANCE.

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Correspondence.

Notes from Washington, D. C.

To the Editor of the Scientific American:

On Sunday morning, August 16, intelligence reached this city of the death by drowning of Ex-Commissioner S. S. Fisher and his son, during a pleasure excursion (in the Rob-Roy style) upon our inland waters. Last month, Mr. Fisher left Cincinnati, with his son Robbie (who was about twelve years of age), in a fine metallic boat, built at Cleveland, which was well stocked with provisions and camp equipage; and a few days afterward they arrived at the beautiful Canandaigua Lake, lying in Central New York, where they launched their boat and immediately proceeded to make a tour of the long chain of inland waters which grace the interior of the Empire State, and thence *via* the Erie canal to Elmira. From Elmira they went to Towanda, Pa., where the boat was again launched in the picturesque Susquehanna, down which they were passing when the terrible accident occurred which deprived both of life. On Friday morning the little party left Harrisburg at 7 o'clock. At 11 o'clock the boat and occupants were seen just above the falls. At 1 o'clock the boat, with oars, papers, and baggage, was found floating down the stream; unguided and alone, below the rapids. The Colonel's body was found near York Haven late in the afternoon of the same day, about twenty miles below the rapids where the accident is supposed to have happened; but his son's remains were not recovered until the following Monday, some five miles further down the river. The bodies were embalmed and sent to Cincinnati for interment, which takes place to day.

As a curious incident in connection with his death, it is stated that, on the Sabbath before leaving home, he described to a Sunday School the supposed feelings of Pharaoh and his hosts when they were swallowed up in the Red Sea, drawing a vivid and terrible picture of the feelings of drowning men: little thinking that he would so soon experience that which he so graphically illustrated.

The following order was issued yesterday by Commissioner Leggett:

"UNITED STATES PATENT OFFICE,
WASHINGTON, D. C., August 18, 1874.

The news of the sudden death of Hon. S. S. Fisher, late Commissioner of Patents, has cast a pall of sadness over all connected with the Patent Office. We remember him as an affable, genial, generous friend and companion—a kind, courteous, just, and laborious officer—a high-toned Christian gentleman, always commanding the love and respect of all who came in contact with him.

Colonel Fisher's administration of the Patent Office was th beginning of a new era in its history. He did more to adapt the organization to the increased business of the Office, more to establish uniformity in the practice and decisions of the Office, and more to make such decisions and practice attainable and intelligible to the public than had been done before. He ably discussed and satisfactorily settled many questions which had long vexed and harassed the Office. The impress of his clear head and strong will are discernible everywhere, and his administration will ever be regarded as an epoch in the history of our patent system.

In memory of his personal and official integrity, of his great ability as Commissioner, and of his eminent virtues as a good citizen and a Christian gentleman, the Office will be closed on August 20, the day of his funeral.

M. D. LEGGETT,
Commissioner of Patents."

The surviving family of the deceased consists of a wife and two children, who are probably well provided for, as his practice was very lucrative, his last year's income being estimated at $45 000 In addition to this, his life was insured for $10 000 in the Traveller's Accident Insurance Company of Hartford, and in the Connecticut Mutual for the same amount.

Washington, D. C. OCCASIONAL.

Hardening and Tempering Tools.

To the Editor of the Scientific American:

Your correspondents, "Tools" and Mr. Juan Pattison, seem to have great objections to the words "film of oxide," used by me, as though they expressed something of an occult nature and beyond the comprehension of the mechanic or artisan; and I judge from the tenor of their communications that they have somehow imbibed the idea that my original letter is the work of a mere theorist, without practical experience. It may, perhaps, be a relief to them to know that, notwithstanding the gist of my letter was taken from a lecture to the engineers at the Naval Academy, the principal points referred to therein were discovered and largely experimented upon by the writer during over fifteen years of shop experience of the very best kind, ten of which were passed in one of the first and largest establishments in this city, that of Messrs. R. Hoe & Co.

I have a more elevated opinion of the American mechanic, from my long association with him, than to believe, when he is told that the colors appearing upon the surface of a tool which he is tempering are caused by the union of the oxygen of the air with the metal, that if the time be unduly prolonged in producing it, or that, if in the operation he excludes the air from it, his results will be valueless unless these conditions are taken into account, that he will regard so simple, so plain, so very practical a proposition as something too deep for him, but rather that he will set himself at once to apply the test of a trial for himself.

If the mechanic of today is really so obtuse, he must have retrograded not a little in the past ten or 15 years. I believe, however, that this is exactly the reverse of the truth, and I have long ago become convinced that the known superiority of the American mechanic over the average European is mostly due to the fact that he always seeks for the why and the wherefore; he wants a reason for the faith which is in him; he is not satisfied to work, like his European brother, by the rule of thumb.

Already I am in receipt of communications thanking me for a little light let in on difficulties experienced for years in tempering tools, and for which the communicants could not, till now, account. Mr. Rose, Mr. Pattison, and "Tools" may as well think the matter over a little more carefully; if they will, I must believe that they will not be willing to ignore two of the most essential readings of what I have called "our color thermometer."

I have noticed frequently, in discussions of this kind, that on the part of many there appears to be an impression that there is some kind of a natural antagonism between what is called theory and practice; but there is no such antagonism. Correct theory makes good practice. Practice without theory is the rule of thumb; and but for theorizers and their theories, the productions of our factories would be today what they were two hundred years ago

The eminently and thoroughly practical man was very happily described in your issue of August 8, in him who borrowed your journal from his neighbor in the cars, and who "never learned nuthin' from books in his life." But I am glad to believe that thereare, at this day, few such remaining, tthat the American mechanic is capable of reasoning and being reasoned with, and that he is always the better for a little good sound theory wherewith to improve his practice.

JOHN T. HAWKINS.

62 Cannon street, New York city.

To the Editor of the Scientific American.

Your correspondent, J. T. Hawkins, insists on the value of the fact that the color on steel is caused by a film of oxide. Is this true? The hardness and temper of a piece of steel vary as the carbon contained therein; and why an oxidized surface should be cited as an indication, I do not know.

Nobili asserts that these colored films are the results of a carbonizing treatment, and that this accounts for the non-rusting of steel covered with such coatings. If the fibers were oxidations, the rusting would be largely accelerated by them. J. T. N.

New York city.

Honey, Strained or in the Comb.

To the Editor of the Scientific American:

The public are apt to believe that all honey which is out of the comb is impure, and that all comb honey is pure. There are several bee keepers in this neighborhood who produce a great deal of honey for market, and who extract it by a machine. There are a few about here who feed their bees with sugar sirup, and their bees put it into combs, and it is then sold to persons who believe that none but comb honey is pure. We, however, know that what we extract by our machines is just what the bees themselves bring in without any inducement or compulsion. By the use of the extractor, the yield of honey is increased perhaps five fold; but, on account of the unfounded prejudice in favor of comb honey, our producers of extracted honey have some difficulty in introducing it.

On account of the prejudice against extracted honey, and also on account of the ease of putting manufactured honey into the combs, the only way for producers of pure honey to succeed is to be honest, and gradually establish a reputation for honest dealing, which will sell their products at best rates. The idea that honey in the comb is, on that account, pure is totally wrong, and should be abandoned. Extracted honey (not strained, but extracted by a centrifugal machine), properly settled and drawn off into bottles, of which we have in this neighborhood not less than ten thousand pounds this season, is as pure as any in the comb, and purer than much of it. The purchaser gets it perfectly free from wax, and is not obliged to press it out by the use of his teeth.

I send you, with this, a bottle of honey from each of two of our producers, so that you may judge not only of its quality, but also of the means they are employing to introduce a pure article in such a manner as to inspire and confirm confidence. I send you also a communication received from one of our apiarians, in which he shows his product to be 79 + lbs. from each hive. This is a large yield, although this has not been a good season here. Last year, this same apiary produced about 150 lbs. per swarm, another 135 lbs., and still another about 150 lbs. H. W. S.

Cincinnati, O.

Performance of Small Engines.

To the Editor of the Scientific American:

I have made a small engine, with a 4 inch cylinder, a 2 inch crank, and a 16 inch pulley, with a 5 inch face. The fly wheel is 26 inches in diameter, weighing 125 lbs. It runs at 240 turns per minute, with from 30 to 40 lbs. of steam. With this engine I am running 40 feet of 2 inch shafting, and 40 feet of $1\frac{7}{16}$ inch shafting, 2 engine lathes, 2 speed lathes (one for turning wood, and the other for drilling iron), 1 chucking lathe (swing 30 inches), 2 grindstones. 1 upright drill, and a pump for pumping water into the boiler; and I have power to spare. I have made with this engine one of 16 horse power, and I am now making one of 25 horse power, besides doing other work.

My boiler is a six horse upright tubular, with thirty tubes $1\frac{1}{4}$ inches diameter. It is not covered in any way, but stands perfectly naked; and I am pumping cold water into the same. I am running this engine and doing this work at a cost for fuel of 50 to 60 cents per day of 10 hours. I cannot tell you the amount of water evaporated, as I have made no note of it. J. HERBERT BULLARD.

Barre, Mass.

[For the Scientific American.]

POPULAR FALLACIES.

The age of war and conflict is fast passing away, and the industrial and commercial age is taking its place. Progress is the world's watchword today; and it is the boast of the nineteenth century that, since its birth, the march of discovery and invention, in all the sciences and arts most conducive to man's comfort and civilization, has been greater than in any preceding half thousand years. Science is now the measure of a nation's standing: for general scientific knowledge means education, which means refinement and religion, which means death to superstition. And in this country especially, where education and true religion are so generally diffused, Science seems to have a stronghold upon the respect and admiration of all but the most ignorant and backward minds.

In view, then, of this general diffusion of scientific knowledge, which in this country, though not in itself astonishing, is yet great when compared with that in most other lands, it does seem remarkable oft-times that so many old and long exploded fallacies should still find credence among the majority of people, and even among the well educated. It is fairly astounding to see what outrageously absurd stories will circulate through the popular press, often published in the fullest good faith, and accepted as true by simple minded readers. The scientific hoaxes perpetrated in the United States are almost innumerable; and that they continue to be published, republished, revamped, and, strangest of all, believed, and solemnly discussed in journals that ought to know better, does not speak well for the thoroughness of this scientific knowledge, on whose diffusion we so often pride ourselves.

We remember a recent example in the story, lately published in a California paper (these hoaxes generally emanate from the fertile West), concerning a magnetic cave, said to have been just discovered, possessing such powerful attraction that hatchets were drawn from the hands of the explorers and flew to the roof, remaining glued there; while unfortunates in hobnailed shoes had to leave their foot encasements behind them. This story, though laughed at by one half the community, was received with open eyes and gaping mouths by the other half, who could not comprehend that the size of the attracted body might have something to do with the force of attraction.

But it is not merely of these ingenious hoaxes that we wish to speak, but of a far more injurious state of ignorance among the common people. We refer to popular fallacies concerning the sciences of everyday life, and to the general ignorance about the great forces of Nature, and the first principles of Science in all its departments. Some of these fallacies are simply ludicrous; others are worse. What absurd blunders are made in matters of hygiene! The prosperity of quack doctors who have medicines, each one of which will cure all the ills that man is heir to, is a forcible example of the latter case. And where we see newspapers—secular and religious—advertising their poisonous wares, we can hardly tell whether to call them stupid or wicked.

"By looking into a looking glass inclined at 45°, Mr. ——, of Northampton, obtained last night a fine view of Jupiter's satellites," says a certain Springfield paper. How Professor Snell, of Amherst, must have chuckled to read it! Mr.——'s wonderful glass would have conferred satellites upon every star in heaven. He should have known that plain looking glass has no telescopic power, and that his "satellites" were only repeated reflections, between the quicksilver and the front surface of the glass, of the planet he was gazing at.

"Mrs. —— was recently saved from death from a lightning stroke by her son, who dashed a pailful of cold water upon her. It is supposed that the water carried off the electricity remaining in her body, and saved her!" Such is the Boston *Journal's* lucid explanation of a simple cure. The poor lady, almost killed by the terrible stroke, was saved by the sudden nervous shock caused by the cold water which her son with such presence of mind threw at her. It is not the presence of electricity in a human body that endangers, nor even the discharge of that electricity, since the body can hold but a small amount; it is the passage through the body of an immense discharge, between clouds and earth, that kills and destroys.

Old maids, and young ones too, throw themselves upon a feather bed for protection from "thunder," or descend to the cellar. An iron bedstead would be safer than either of these places, because it would keep the charge away from them by receiving it through itself. Timid ladies are terrified when a boiler discharges steam through a safety valve, for fear that it will burst; when the roar of escaping steam is proof positive that it will not burst. And to crown all, some misguided victims of an insane fever, forgetful that "action and re-action are equal," and that "gain in power is loss in time, when the force is given," still labor and strive to create force out of nothing, and make what Science has, time and again, declared impossible, a perpetual motion.

Such absurdities of course will never cease, until ignorance ceases. But they are altogether too common among those that should know better, and reveal a great lack of logical reasoning and definite knowledge. Superficiality is perhaps the great fault of our common education, especially in Science, where exactness is so essential. The natural and exact sciences are, we are happy to say, taking more nearly their deserved stand in our American educational courses; and we hope the time may come, and come soon, when such nonsense as we have discussed cannot possibly be found, much less believed in, among those who have been fairly educated. A. H.

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MEDICAL NOTES.

Copaiba in Croup.

If the following remedy should prove a universal one, the saving of young life would be enormously increased:

Drs. Miller and Lincoln, in the "Transactions of the Medical Society of the District of Columbia," vol. I., No. 1, relate several cases of croup cure by balsam copaiba, and refer to many others. Dr. M. had used copaiva extensively in croup for 30 years, and had before spoken of its efficacy, in the Society. He was in the habit of placing a vial of the balsam in possession of all his patients whose families were subject to croup, directing them to take doses of 20 or 30 drops before sending for medical aid. The result was that, while he was formerly frequently called out at night to attend croup cases, he was then but seldom annoyed by similar calls. So great was the faith of his patients in this remedy that he had often been applied to for his so-called croup medicine. It was especially valuable in the early stage. Dr. Lincoln had never seen copaiba fail if given in the first stage of the disease, and had derived great benefit from it in every period of the complaint. He thought the remedy of great use, even in the pseudo-membranous form of croup. His dose was one drachm which gave prompt relief.

Guarana in Chronic Rheumatism.

Dr. Edward A. Rawson, assistant surgeon to the Carlow Infirmary, says: "Suffering severely from lumbago, and finding all vaunted remedies fail, I tried guarana as an experiment. I took 15 grains in hot water, with cream and sugar. For 24 hours afterwards I had a delightful relief from pain. On the return of the lumbago, I took another dose in the same manner, and with a similar result. I gradually increased the dose to 40 grains, and took it regularly once a day for about a week. The lumbago disappeared. I gave up the guarana, and in a few days the pain in the back returned. A 40 grain dose removed it, and it did not return for several days. Whenever it does, I have my remedy at hand." Dr. Rawson goes on to say that he has tried guarana with a variety of patients, rich and poor; and if the pain is acute, coming on with sharp stings, guarana acts like magic; when it is of a dull, aching character, the drug is slower in its action, and several doses must be taken before any decided benefit can be perceived. He comes to the conclusion that, whenever the fibrous envelopes of nerves, the aponeurotic sheath of muscles, or the fasciæ or tendons are the parts affected, guarana gives either instantaneous or speedy relief, which will last from 12 to 24 hours; and he thinks that perseverance in the use of the drug, gradually increasing the dose to 40 grains, will finally entirely remove any of the above named kinds of rheumatism. Guarana was examined by Martius in 1829, and by Gravelle in 1840. They declare that it stimulates and at the same time soothes the gastric system of nerves, diminishes febrile action, and strengthens the stomach and intestines, particularly restraining any excessive mucous discharges; at the same time increasing the action of the heart and arteries, and promoting diaphoresis.

This medicine is a preparation of the seeds and juice of the *Paullinia sorbilis*, a Brazilian plant, of which wonderful stories have been told by travelers. Its effects appear to be various, some of them similar to those of tea and coffee in stimulating the nervous system. The Indians consider it a specific for bowel complaints. Dr. Graville found it advantageous in the diarrhœa of phthisis, sick headache, paralysis, tedious convalescence, and generally as a tonic. Dr. Ritchie recommends paullinia in irritation of the urinary passages. Dr. Herve never failed to derive benefit from it in the most obstinate cases of idiopathic diarrhœa. It cures both headache and neuralgia by restoring the tone of the gastric membrane, and removing all pains caused by irritation of the stomach. Though not an astringent, its peculiar action renders it a most valuable agent in all affections of the bowels, whether simple or chronic diarrhœa, dysentery, or choleraic discharges. In France it has cured attacks of cholera when the evacuations have been at the rate of 30 an hour. It is also said to be prompt and certain in dysentery, curing the very worst cases. From all appearances, no new medicine rivals it in value.

An Ingenious Substitute for the Hypodermic Syringe.

In the Edinburgh *Medical Journal*, Dr. John M. Crombie, states that many medical men are often deterred from using morphia hypodermically on account of the expense of the syringes, and the pain they cause the patients. To avoid these, he advises the use of small threads coated with morphia and passed through a fold of the skin by fine needles. The threads may vary in strength from one sixth to one grain of morphia.

Diabetes.

Dr. O. Schultzer claims great success in the treatment of diabetes under the free use of glycerin, internally, with citric acid, and abstinence from starchy food.—*New Remedies.*

Diastase as a Digestive Agent.

The substance here named, says Dr. Collens C. Hunt, in the *Physician's Monitor*, which is believed to be new as a remedial agent, was first employed by William Elmer, M. D., of New York, who has given it a fair trial for a year or two, with most gratifying results. It not only aids in the digestion of starchy food, but seems to impart vigor to the digestive functions generally, and through this action supplies energy to the brain and nervous system. For some of the worst forms of indigestion, the use of diastase has had the effect, in particular, of producing the most tranquil and refreshing sleep, and that where, previously, satisfactory sleep had been almost unknown. This result is attributed to the digestive power of diastase more than to any other property it possesses. Diastase may be given in the form of a sirup or in lozenges. The dose is from 1 to 2 grains directly after each meal. The sirup should be prepared with glucose rather than with cane sugar; but any sirup has the great objection that it is required to be kept cold, or the diastase is liable to turn sour.

Iron Purifies Water.

Almost all large water pipes are of iron, as tax payers well know when they are called upon to replace the old rusty mains with new ones every few years. But, according to good chemical authority, the iron has an advantage with its defects. Professor Medlock proved by analyses, several years ago, that iron by its action on nitrogenous organic matter produces nitrous acid, which Muspratt called "Nature's scavenger." The latter chemist found, as a general result, that, by allowing water to be in contact with a large surface of iron, in about 48 hours every trace of organic matter was either destroyed or rendered insoluble, in which state it could be purified effectually by filtration. Medlock found, on examining the water at Amsterdam, which smelt and tasted badly, that the sediment charred on ignition, and was almost consumed, showing that it consisted of organic matter. He also found that, instead of taking iron from the service pipes, the water before entering those and an iron reservoir contained nearly half a grain of iron to the gallon; while in the water issuing from the pipes, there was only an unweighable trace. Before entering the reservoir, the water holding iron in solution formed no deposit; while the water coming from the pipes and freed from iron gave the organic sediment above mentioned. He then made analyses of water brought in contact with iron, and water not in contact, with the result that the water which had not touched iron contained 2·10 grains of organic matter, and 0·96 grain iron; the other gave only a slight trace of both, showing plainly that the organic matter in the water was either decomposed or thrown down by contact with iron; and this water, when filtered, was found to be clear, of good taste, with no smell, and free from organic matter. It is not stated in what shape the iron was held in solution, but it was probably in that of carbonate, the usual iron salt of springs, since carbonic acid is so common in water in general. These facts may be made useful in certain places and ways in effecting the purification of water rendered injurious and offensive by the presence of organic substances. And if the interiors of iron mains could only be kept from rusting by a swabbing with nitric acid, or by a paint of charcoal and plumbago, so much the cheaper.

SCIENTIFIC AND PRACTICAL INFORMATION.

MANGANESE IN SEEDS.

A chemical analysis made of seeds known as tapayons, which were brought to France by a missionary from China, has revealed the remarkable fact that the ash contains 17 per cent oxide of manganese, 14 per cent of magnesia, and 12 per cent of lime. This amount of manganese is much greater than is recognized in the leaves of the beech tree or in any other vegetable.

COPPER, A PREVENTIVE OF CHOLERA.

M. Burg, in a recent memoir to the French Academy of Sciences, states that workers in copper are never attacked by cholera, while the operatives whose labor in other metals is of similar character form no exception. This fact has not only been observed in France, but in Italy, Russia, Sweden, Spain, and Turkey. M. Burg concludes that copper acts as a protection against the disease, and advises the use of salts of the metal as a preventive medicine.

SCIENTIFIC MARKETING.

There is Science in this last attempt of our transatlantic cousins at household financiering, a great deal more Science than is necessary to accomplish that timeworn desideratum of making two blades of grass grow where one before flourished. By an ingenious little transfer of checks and bonds, a man may get his daily bread for nothing and be paid besides. A company sells tickets to a tradesman at a premium of five per cent of face value. Then the latter hands these over to his customers in quantities equal in amount to the cost of the goods bought, allowing the 5 per cent for ready cash. Then when the customer gets $25 in tickets, he goes to the company and receives a $25 bond in exchange. Meanwhile the tradesman's 5 per cent is put out at compound interest, and the profits accruing enable the company to make their own profit and besides pay off the the bonds by ballot. Consequently, the customer not only eats his cake but more than has it too, for his whole expenditure is returned with interest.

SONOROUS SAND.

The New York *World*, in a report of a scientific meeting in San Francisco—the name of the association is not stated—gives an account of a very curious property of sand which is found in a large drift on the Island of Kanai of the Hawaiian group. The bank is about sixty feet high, quite steep, about one and a half miles long, and extends parallel with, at some hundred yards from, the beach. If, at the extreme south end and for half a mile north, two handfuls of the sand be slapped together, there is a sound produced like the low hooting of an owl—more or less sharp, according as the motion is quick or slow. Sit down upon the sand and give one hand a quick circular motion, and the sound is like the heavy bass of a melodeon. Kneel upon the steep incline, extend the two hands, and clasp as much sand as possible, slide rapidly down, carrying all the sand you can, and the sound accumulates as you descend until it is like distant thunder. In this experiment the sound was sufficient to frighten horses, fastened a short distance from the base of the drift. But the greatest sound produced was by having one native lying on his belly, and another taking him by the feet and dragging him rapidly down the incline, carrying as much sand as possible with them. With this experiment the sound was terrific, and could have been heard many hundred yards distant. With all the experiments that were made, it seemed that the sound was in proportion to the amount of sand put in motion with a proportionate velocity. Another consideration seems requisite—that is, its perfect dryness. The dry sand would sound on the surface where six inches beneath it was wet; but if any of the wet sand became mingled with the dry, its property of sounding ceased at once. The sand appears to the eye like ordinary beach sand, but ordinary beach sand will not produce the sounds. It has been said that it lost its sonorous properties when taken away from the bank, but no diminishing of its sonorous qualities, even with the bottle uncorked, was noticeable.

OUR NEW GOLD REGION.

The practical results of General Custer's expedition in southwestern Dakota are beginning to appear. This hitherto unknown region, as far as entered, has proved to be covered with magnificent timber and grazing, superior even to the famous Blue Grass country, in Kentucky. The valleys are admirably adapted to agricultural purposes, and the scenery is said to be lovely beyond description. In addition to these natural advantages of the country, gold, it is stated, is being found in great profusion, though no official investigation as to its richness has thus far been made. Veins of what geologists term "bearing quartz" crop out on every hillside, and from forty to fifty particles of pure metal, each as large as a pinhead, have been taken from the washings of a little over a single pan of earth. If the further reports from the expedition prove as satisfactory as this first one, another gold fever and rush of emigrants to prëempt land will be very probable.

RAW HIDE BELTS.

In driving centrifugal sugar machines, Mr. J. Mason, of the Island of Bardadoes, found the use of the ordinary leather belts to be troublesome and expensive. He, therefore, substituted belts of raw cow's hide, simply dried in the sun, cut perfectly straight, and the joints, square and even, stitched with saddler's hemp thread. He states that in practice, a belt of this description, will last four times longer than, and cost only one fourth as much as, a leather belt. He uses an 8 inch belt of this kind, to drive a line of 3 inch shafting, from which 2½ inch belts drive the sugar machines.

Carbonic Acid as a Motor.

The possibility of employing carbonic acid as a motor—the successor of steam, as it is termed by the author—is foreshadowed by a paper by Dr. H. Beins, published in the English *Chemical News*. The writer considers that he has discovered a very cheap way of producing carbonic acid in a liquid state and consequently at high tension. When natrium bicarbonate, or the corresponding salt of kalium, in a dry, pulverized state or in a watery solution, is heated in a closed space, a part of the carbonic acid is given off and condensed in a non-heated portion of that space, so that, at a temperature of from 636° to 843° Fah., liquid carbonic acid, says Dr. Beins, can be distilled out of those salts, with a tension of from 50 to 60 atmospheres. This liquid carbonic acid, or "carboleum" as it is called, it is proposed to use to develop gas with which engines are to be driven. The paper on the subject contains a dissertation on the advantages of the plan, but gives so few details regarding its practical application, or with reference to the manufacture of the carboleum or liquid carbonic acid, that the gist of the matter is summed up in the above lines.

Sulphur in Iceland.

Dr. Blake gives a full and clear description of the vast deposits of sulphur occurring in Iceland, and points out the necessary steps for its utilization. For its shipment he recommends the port of Husavik, which is accessible all the year round, and which is situate very near to the sulphur beds of Lake Myvatu, Krabla, and Reykjahlid. The mines are not only rich and extensive, but easily worked. The sulphur can be supplied at half the cost of that furnished by the Sicilian mines, which it is believed will soon be exhausted. The earth impregnated with sulphur contains from 50 to 60 per cent, and is from three to six feet in thickness. Vapors arising from the interior of the earth continually deposit fresh supplies.

A Gigantic Grain Elevator.

The New York Central and Hudson River Railway Company is now building at the foot of 60th street, on the Hudson River, in this city, a grain elevator, capable of holding from 1,000,000 to 1,200,000 bushels of grain. This elevator will be used principally for storage purposes for the grain brought on in the company's cars, and intended for transferment to sea going vessels and canal boats.

ANNATTO.—In the two French colonies of Martinique and Cayenne, there are more than six thousand acres under culture with annatto (*bixa orellana*), the annual produce being three million pounds. Although French Guiana has nearly five times the extent of land under culture with this plant that Guadaloupe has, it only produces about two thirds of the whole quantity. The production of annatto now exceeds the demand, as no fresh use has been found for this coloring substance, unless it is the manufacture of suet butter. Annatto is used to give the yellow color of true butter.

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A NEW MOTOR.

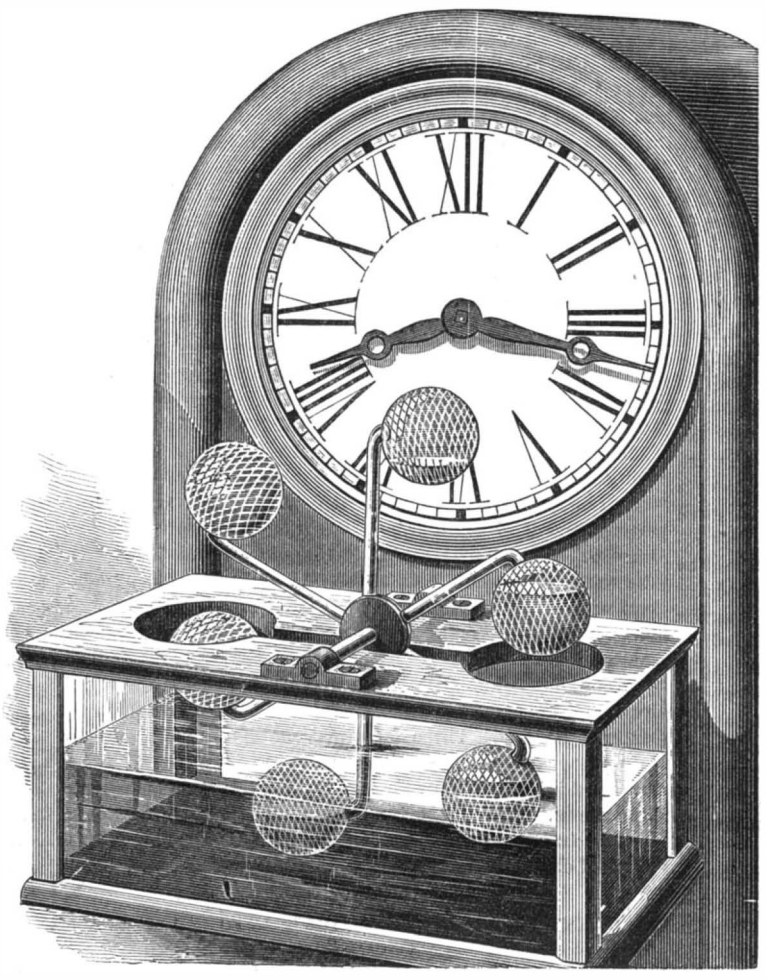
According to the laws of the mechanical theory of heat, any difference of heat may be employed for production of mechanical work. If a cold body, then, be situated in air that is hotter, the passage of heat to it should be capable of giving mechanical work. The solution of this problem (says the *English Mechanic*) M. Enrico Bernardi, an Italian physicist, has recently sought to realize in the following way:

Two similar glass balls are connected together by a thin glass tube, the ends of the tube passing into the balls being bent at a right angle. One ball contains a small tube, by which ether can be poured into the apparatus; the ether is brought to boiling, and, when all air has been expelled, this small tube is closed by fusing. The quantity of ether inclosed in the system should be such as to fill about three fourths of one ball. At the middle of the connecting tube is fixed a piece through which passes a metallic axis, round which the system can turn. When the ether is equally divided between the two balls, the apparatus is in unstable equilibrium. The bearings for the axis are supported on the cover of a rectangular case, and in this cover is a slit through which the turning system passes. The case is filled with water, into which the balls dip alternately on their being turned round the axis. Each ball is covered with a very fine veil. It is easy to see that this apparatus will take a see-saw motion

Owing to the unstable equilibrium of the system, one of the balls, A, sinks, and all the ether flows into it, while the rest of the space is filled with the vapor. The ball, A, is then in water, the ball, B, in air. Hereupon the moisture on the surface of B begins to evaporate, and the ball is so cooled that the vapor within condenses; from the ball, A, more ether is evaporated, and it is condensed in B, till at length B contains more ether than A, and sinks, while A rises; and the same process is repeated. This see-saw motion lasts as long as there is water in the case to moisten the surface of the under ball.

It would be rather troublesome to utilize this thermo-motor see-saw mechanically; and M. Bernardi has, therefore, preferred to alter the apparatus in the following way: The two balls of the above described system are connected by a tube, the ends of which are bent round (at right angles) to opposite sides. Three such systems are formed into a sort of wheel, the middle points of the six balls and the tube being in one plane. This wheel is supported at its axis, on the cover of a rectangular case, in such a way that, in its rotation, it is always half within the case and half in the air. The balls are covered as before, and so much water is poured into the case that, in turning the wheel, one ball is always immersed. By giving the wheel a turn, it can be set in continuous rotation; and, with a suitable arrangement of pulleys, it can be made to raise a weight, or do other work.

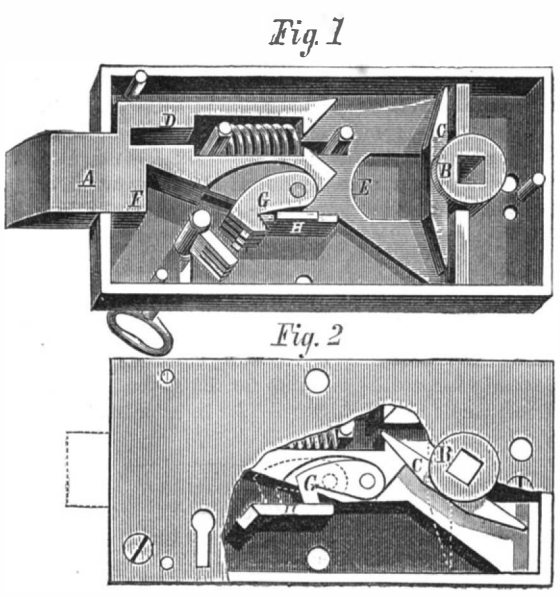
Such a thermo-motor wheel has, for two months, been working a clock in M. Bernardi's laboratory. The balls have a diameter of 0·78 inch; the distance of the middle points of two opposite balls is 3·1 inches, and the quantity of ether in each system fills three fourths of a ball. The clock maintained in motion by this wheel consumes, in 24 hours, 0·2 of a foot pound. The water level is, by a special arrangement, kept constant. M. Bernardi has had his see-saw working for three months without its becoming necessary to renew the water or clean the balls. He has calculated the quantity of heat which is removed by this apparatus from the surroundings. There was an average of 60 see-saw motions in 24 hours. This was found to be equal to 0·12 of a foot pound, or about half the work consumed in the same time by the clock.



BERNARDI'S THERMO-MOTOR

FOLSOM'S IMPROVED LOCKING LATCH.

This invention is a simple, strong, and convenient door lock, which may be opened by the knob and locked by a key, but in which only one bolt and one spring are used.



In Fig. 1, the bolt, A, is represented as shot forward so as to lock the door to which the device is applied. In Fig. 2, the same is retracted (dotted lines), and serves as an ordinary latch actuated by the knob. As shown in Fig. 1, the rear or right hand end of the bolt, A, is flanged and also recessed so as to slide along the knob shank, B, being carried back by the crossbar, C, acting on the flanges. A glance at the corresponding portion in Fig. 2 will render the action of this bar, C, clear

In the middle portion of the bolt is a recess, having small slotted extensions, D. In the former is placed a strong spiral spring, and the latter serve to guide the bolt as it slides over the spring-supporting pins. The action of this spring on either side of the bolt serves to carry the latter back to its original position, whether being operated by knob or key. A rectangular recess is made at E, equal to the distance from the crossbar, C, to the rear flanges, and allows of the forward motion of the bolt by means of the key acting on the shoulder, F.

At G are one or more pivoted catch hooks which enter recesses in the bolt and slide, during the to-and-fro motion of the same, with their hook ends along a horizontal guide plate, H. The front end of this plate is slotted, and has a slight downward inclination, so that, when the hooks are carried far enough forward, they drop into and interlock with the slots. The key is so made as to enter these slots, and pass between and through them. It then strikes the shoulder, F, and carries the bolt forward. This carries the hooks also far enough forward to drop with their ends into the recesses of the guide plate, so that they thus hold the bolt firmly locked.

To unlock the latch, the key is turned in the same direction as before, thereby lifting the hooks out of the guide plate recesses, when the spiral spring pulls the bolt back to its former condition.

The advantages claimed are simplicity, durability, and also cheapness of manufacture, owing to the fewness of parts. It is also very difficult to pick, as the key has to pass a very difficult guard and, as already explained, to strike a number of catches and raise them to a certain hight. It cannot be unlocked with a wire, since every catch must be lifted, and, in brief, every lock must have its own special key. It operates by the knob with as much ease as the ordinary latch, and cannot be thrown back by force applied to the knob when locked.

Patented through the Scientific American Patent Agency, June 30, 1874. The inventor, Mr. F. W. Folsom, of Taylor's Falls, Minn., who may be addressed for further information, desires either to sell the patent or to make arrangements for the manufacture of the device on royalty.

T. Marr Johnson, C. E.

We regret to announce the sudden demise of this widely known engineer, which took place in England, July 22. His age was 48. Between the years 1860 and 1869 he was occupied, under Mr. John Fowler's instructions, in carrying out the works of the Metropolitan Underground Railway system in London. He was employed upon many other important works, and held a distinguished professional position. At the time of his decease, he was a member of the firm of George Smith & Co., builders and contractors.

Metachloral.

M. Lemousin has obtained metachloral by treating one part of chloral hydrate with three parts concentrated sulphuric acid, and washing the insoluble product obtained until acid reaction ceases in the washing water. The metachloral is then dried by chloride of calcium and reduced to fine powder. It has the same formula as anhydrous chloral ($C_4 H Cl_3 O_2$) of which it is an isomeric modification. It is less caustic than chloral hydrate, and has a great advantage over the latter in not absorbing moisture.

Spontaneous Combustion.

We are inclined to believe, says *Engineering*, that one great cause of spontaneous combustion, in cotton and woolen mills, rests on the length of the fiber of the material left as oily waste. The finer this fiber the greater is the danger of spontaneous combustion, and this becomes evident from the fact that in such cases the particles of the materials are in closer contact. In all our large docks of London, Liverpool, etc., thousands of tuns of long stapled sheep's wool, imported from Australia, the Cape, and other places, full of animal oil, remain perfectly safe for years. In their transit, the bales containing such wool must have attained a temperature of at least 80° to 90°, yet we never hear of spontaneous combustion, either in the ships or the docks. But then comes the question of the character of the oil—as to whether the animal or the vegetable is the more dangerous. The late Dr. Graham, in reporting on the burning of the Amazon, considered that rags greased by butter, heaped together, would take fire within 24 hours. We question very much whether silk or sheep's wool is liable to spontaneous combustion, even in the presence of abundance of oil. Cotton, jute, all kinds of hemp and flax, mixed with oil, have an invariable tendency to spontaneous combustion at summer heat.

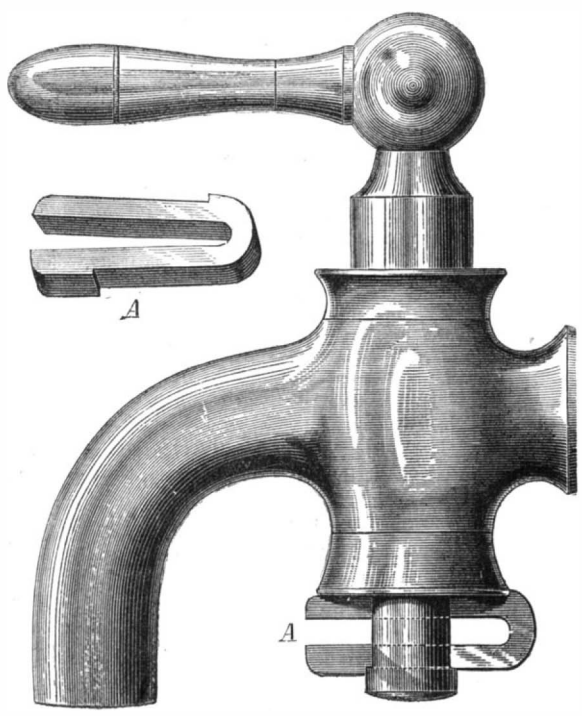
The only apparent remedy seems that of maintaining constant ventilation in all waste, etc., containing oil. Frequent turning is essential, and we have tried successfully the sprinkling of such waste with waste lyes or lime water. It is remarkable that jute warehouses are peculiarly liable to catch fire in fact, all members of the hemp and flax family are to be more feared than varieties of cotton.

A singular cause of fire may be traced to the glass of which the windows of warehouses is made. In the old fashioned kind the "punty" mark is found. This forms a double convex lens, which, concentrating the rays of the sun, constitute a burning glass. That fire should occur from such causes can be no matter of surprise. Water bottles exposed to the sun's rays have sometimes similarly caused fires in private houses by concentrating the heat rays on dressing table covers, etc.

WEBSTER'S IMPROVED FAUCET.

Our illustration represents a simple substitute for the screw, nut, and spring washer usually employed to secure faucet plugs in place. The inventor informs us that the device has now been in successful use in Brooklyn, N. Y., for several years, and that, in addition to other advantages, it possesses the important one of cheapness, as it can be manufactured for ten cents per faucet.

It consists of a spring key, A, punched out of ordinary brass, and inserted in a suitable slot in the lower part of the plug. It is claimed to take up all wear, and hence not to work loose, as frequently occurs with the usual screw and washer. By holding the plug in proper position, it also prevents grit or dirt from getting between the plug and the barrel of the faucet, making it self-grinding and obviating the necessity of frequent repair. Finally, by its yielding to expansion and contraction, the device is well adapted for use with steam or hot water, while, besides, it prevents the chambers from being spoiled by freezing.



Patent for sale for the United States. Proposals for purchase should be addressed to Theo. L. Webster, M. M., U. S. Navy Yard, New York city.

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MANUFACTURE OF MORTAR BRICKS.

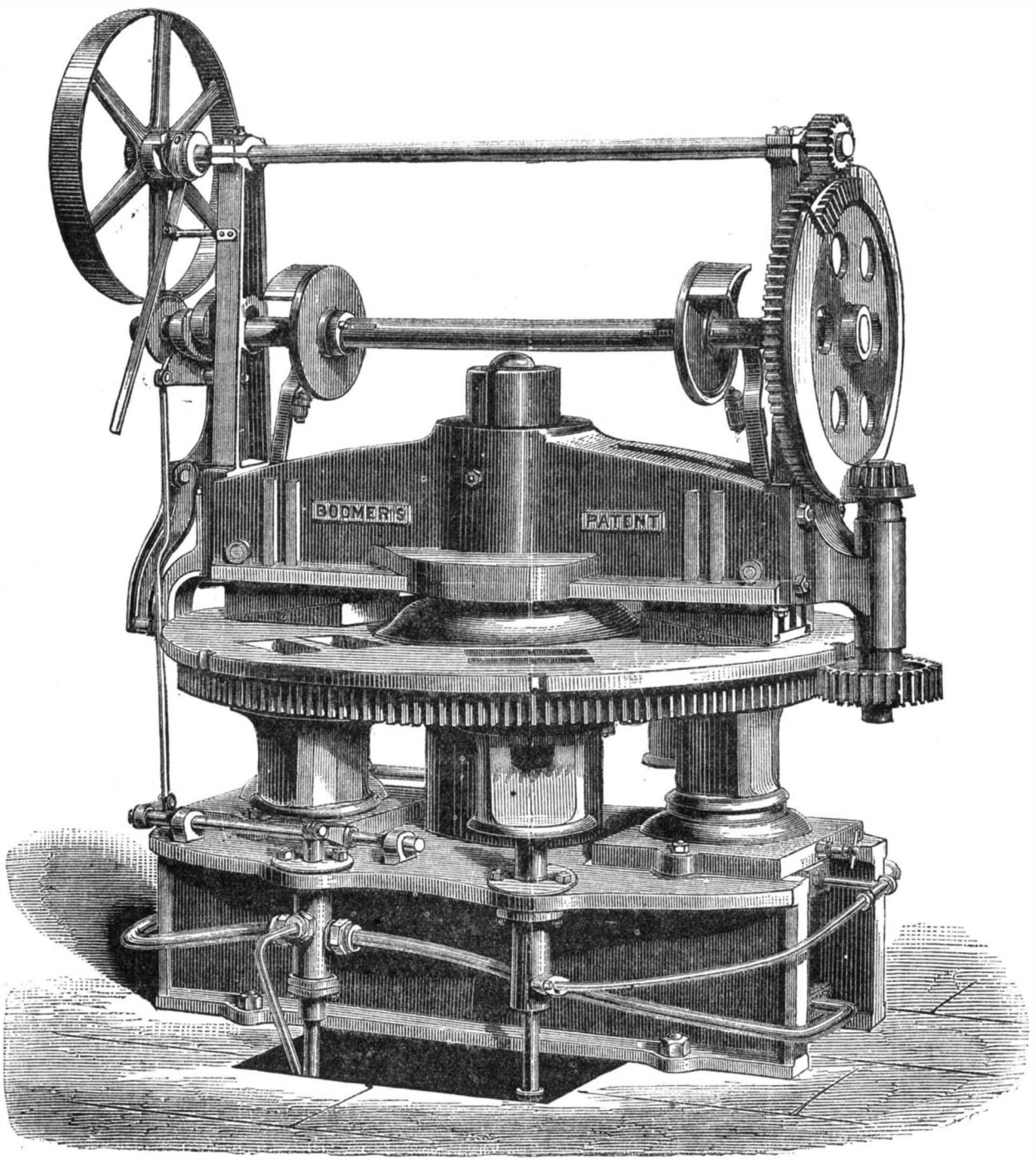
Among the objects at the International Exhibition, London, which, though very interesting, are so modest in appearance as to be passed over by most without notice, are a number of bricks made not only without straw, but without burning.

The bricks are practically mortar, seeing that the materials of which mortar is commonly made are those which alone enter into their composition. Sand and lime form one variety of brick; sand, lime, and Portland cement make another. Pressure and air drying are the only operations, beyond the first mixing, that are necessary. At first thought it might be objected to such bricks that they would probably be too friable or too soft for use; but the sight of a piece of good old mortar should convince the doubtful that the hardening influences of time and carbonic acid—resulting in the production of a marble-like carbonate, and possibly silicate, of lime—are quite equal to those of the kiln. Bricks are also formed by pressure of mixtures of subdivided slag with lime, Portland cement, and blast furnace slag cement respectively The slag cement itself is composed of from eight to ten parts of slag, and one part of lime. But little surprise need be felt at the employment of slag in the preparation of cement, since the chief condition for success is the presence of a silicate capable of decomposition by lime—a condition which is fulfilled by powdered slag.

The bricks give a good result on application of the usual tests. They have a good sound ring, are very hard, and can be made of various shades of color, or even enameled, we should imagine, by a little ingenuity.

The process of mortar brick making by the machine is simple. Hoppers are filled by hand with the materials employed, each into its separate hopper. From this point to the removal of the finished bricks all operations are automatic. Measured portions of each ingredient are caused to fall upon a traveling belt which delivers the mixture into an apparatus, in which it is thoroughly incorporated, and from which it is deposited upon a second traveling belt, which carries it to the press, where measured quantities are delivered into the molds. The press is hydraulic, consisting of a circular table revolving horizontally, and of course stopping when pressure is applied. The table contains six pairs of molds, making, therefore, one sixth of a revolution between the stoppages for application of pressure. Two pairs of molds are subject to pressure at once, two other pairs being automatically filled, and the bricks rising out of the remaining two pairs, simultaneously. The bricks are removed by hand to barrows, and conveyed to the yard, where they are left to harden. The time required for this varies according to the quality of the lime used, and also according to the weather, from one to two months, but the hardening goes on for years. Seven strokes per minute are made by the press, giving in that time twenty-eight bricks, or about 80,000 per week, as the result of the labor of two men and four boys, exclusive of wheelers and pilers. When sand is used, from one sixth to one eighth of its weight of lime is necessary; but with slag, as little as one sixteenth of its weight of lime may be employed to produce a good quality of building brick, weighing about 58 cwt. per thousand.

Bricks of this kind have long been in use in the United States. The machine above represented, which we copy from *Iron*, is made by Messrs. Bodmer, Hammersmith, England.



HYDRAULIC PRESS FOR MAKING MORTAR BRICKS.

Improvements in Sugar Making.

The methods of purification employed in the sugar manufacture depend almost entirely upon the action of lime and its elimination by carbonic acid. These processes leave, in the saccharine products, a certain proportion of organic matters and mineral salts, which oppose, to a certain degree, the crystalization of the sugar, causing also the formation of molasses and the mingling of the sugar with the residue. M. P. Lagrange has recently devised a method which is based on the elimination, by the joint action of baryta and phosphate of ammonia of the organic salts of lime, of certain vegetable acids combined with potash and soda, and of the alkaline sulphates existing in the sugar products. By this process, without the aid of lime or salts of lime, M. Lagrange believes that he is enabled to obtain the products, and to secure the best conditions of alkalinity, without forming glucose at the expense of crystalizable sugar. In factories, therefore, devoted to the manufacture of cane sugar, it would seem that this improvement is of considerable importance, as doing away with the serious difficulties and large losses due to the glucose formation and the lime salts.

M. Marguérite has recently patented a process for obtaining sugar from molasses by the addition to the latter of certain salts which provoke crystalization. The process is said to be especially valuable in treating third quality sirups as well as molasses. The operation consists in adding to the spent molasses (containing, say, fifty per cent of sugar, fifteen per cent of salts, and twenty per cent of water) crystalized sulphate of magnesia in the proportion of twenty per cent by weight, together with a little water, to make a solution of the sulphate marking 10° Baumé. The whole is then subjected to centrifugal action in a machine having either perforated sides or very fine wire cloth. The sulphates of lime and potash precipitated are retained, and the liquor is then filtered through charcoal and boiled *in vacuo*. After cooling, a certain quantity of pounded sugar is added to form nuclei, and the sirup is lastly subjected to the ordinary temperature of fillings, the heat being alternately raised and lowered.

After a few days, crystalization becomes exceedingly abundant, and continues to increase for some time, after which the hydro-extractor is employed. Other salts, such as sulphate and chloride of magnesium, chloride of manganese, sulphates of iron and zinc, and their chlorides, and also the acetates, nitrates, and ammonia salts, though these are not so desirable, may all be used instead of the sulphate of magnesia, the proportions of which vary according to the nature of the molasses.

The crystalization of the sugar results from elimination of the potash, the salts of which are prejudicial, its place being taken by the magnesia, whose salts are favorable thereto.

WORK has begun in earnest on the Centennial grounds in Philadelphia. Daisies and clover have disappeared, leaving a vast expanse of level, bare, red earth, crossed by railroad tracks, and dotted here and there with shanties.

The New Lake or Sea in Africa.

The French government has recently voted the sum necessary for the formation of a great inland sea in Algeria, 190 miles long by 36 broad, to the south of Biskra. It is thought, by the *Revue des Deux Mondes*, that the result of this measure will be a great improvement in the climate of the interior, a great addition to the facilities for inland transport, and the introduction of commerce and civilization into the very heart of Africa. The Chott Mal-Rir, *Chott* implying the bed of a lagoon, the proposed site of this inland sea is found to be at least 90 feet below the Mediterranean; while the Chott Sellem, with which it communicates, which lies between it and the sea, is 54 feet lower still. A chain of *chotts*, of smaller area but equal depression, extends thence to within 12 miles of the coast of Tunis, at the Gulf of Gabes, and a canal connecting the nearest *chott* with the sea would admit the waters of the Mediterranean, and convert the desolate region of Chott Mal-Rir into a great inland sea. The estimated cost is only three millions of dollars, and the engineering difficulties, after the experience gained during the construction of the Suez canal, would be inconsiderable.

At a recent sitting of the Academy of Sciences, Paris, M. de Lesseps stated that, on the war budget being presented, a sum of $5,000 would be applied for to cover the expenses of the definitive survey of the basin. The engineers intrusted with the operation of cutting through the Isthmus of Gabes will then start from Biskra, with the aid, not only of the Governor General of Algeria, but also of the Bey of Tunis, equally interested in the success of the enterprise.

It has heretofore been suggested in the SCIENTIFIC AMERICAN that, while it was very practicable to cut the proposed canal and admit the water of the Mediterranean to the desert, the ultimate result, owing to the rapid evaporation, might simply be the formation of an immense deposit of salt. This appears to be also the view taken by M. Ch. Honyvet, who, at the above sitting of the Academy, gave a paper on the subject. He observes that the Mediterranean may, of course, be tapped as they propose, and an immense inland sea formed; but that a vast surface of evaporation will thus be exposed to the sun's rays; and that, as the loss of water by this action can only be replaced by the sea through the canal, the end of the whole operation will be the formation of a thick crust of salt at the bottom, whereby all navigation will be stopped in a short time, and millions will have been spent to create a gigantic salt pit, and nothing more.

Artificial Furs.

Mr. Tussaud, of London suggests an ingenious way way of preparing the hair or fur of animals for use without employing the skin. The process consists in first soaking the fur in lime water to loosen the adhesion of the hairs. After washing and drying, the piece is stretched upon a board, fur side up, and a solution of glue laid over it, care being taken not to disturb the natural position of the hairs. After the glue has hardened, the skin may be pulled off, leaving the ends of the hairs exposed. The latter are then washed with proper substances to remove fat, bulbs, etc. An artificial skin of gutta percha, or other waterproof substance, is next laid on top of the glue and allowed to dry so as to form a continuous membrane, when the glue is washed out with warm water. These artificial skins are entirely free from any animal odor, and are more durable, lighter, and more pliable than the natural ones.

THE Mikado is making almost as good a thing out of his reformation as Henry the Eighth did of his. One of the discarded gods of Japan is advertised for sale in a Japanese paper in the following terms: "For sale, at Kama-Kura, a very fine idol with six arms. It is 15 feet high, and was cast in bronze, at Sheffield." Sheffield now shares with Birmingham the doubtful honor of supplying, with impartial generosity, missionaries and bibles to the more inquiring among the heathen, and idols to those who prefer to walk in the old ways.

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PROCEEDINGS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

We continue below our abstracts of the papers read before the Hartford convention. Professor E. S. Morse, in a paper on the ascending process of the astragalus in birds, expressed the belief that the above process represented the intermedium of reptiles. This view he has confirmed by studying the embryo of the common tern.

Professor Wheildon, on the lobster, said that the process of shedding the shell is generally known, excepting perhaps that relating to the large claws. The body opens in a straight line in the length of the back, while the tail, legs, and claws are drawn out from the shell, leaving it entire, as it has been called, an articulated skeleton which is thrown off periodically. It is found that in that portion of the claw near the body a part of the shell decays and falls out, making sufficient room for the passage of the claw. The portion of shell indicated is that small, smooth part that lies flat upon the body. The lines indicating this portion are to be distinctly seen in all lobsters which are approaching the period of shedding the shell, and these become gradually more distinct until that part becomes semi-transparent and finally decays.

In a paper on the significance of classes among vertebrates, Professor Gill considered that no groups of animals should be combined in classes which are more widely differentiated morphologically from each other than are the birds and mammals. The differences between the extremes of the group of fishes are immeasurably greater than are those between mammals and birds, and still more than those between birds and reptiles. Instead of the old classes, birds, mammals, and fishes, we should have eight, combined in an entirely different manner, namely: (1) Mammals, (2) birds, (3) reptiles, (4) batrachians, (5) fishes, (6) elasmobranchiates, (7) marsupobranchiates, and (8) leptotardians.

Professor B. A. Gould, referring to

THE NUMBERS AND DISTRIBUTION OF THE FIXED STARS,

states that, if we assume, according to hypothesis, an equal number of stars in each hemisphere, there are altogether not less than 15,300 stars as bright as the seventh magnitude. But since the count indicates an excess of bright stars in the northern sky, there may be a thousand more, as given by the formula. The numbers of the *Durchmusterung* imply the existence of over 200,000 stars as bright as the ninth magnitudes, though the magnitudes of faint stars in that work seem given on the average a little too bright. The two classes of considerations—the approxmate method furnished by the hypothesis of an equable distribution of stars and the existence of a well marked zone of very bright stars as much inclined to the Milky Way as the equator is to the ecliptic, may assist in determining the position of our sun with reference to its own cluster, that of the cluster itself, and the scale of distances between its constituent stars.

Mr. J. H. Kuppart read an interesting paper on the

EXTINCT HOGS OF OHIO,

in which he alluded to certain fossil remains of animals of the *Iuidae* family, found in digging sand in the city of Columbus, O. The skeletons have a close resemblance to that of the South American peccany, and are the first complete ones ever found. There may be sufficient differences to constitute a new species, the most striking peculiarities about the head of these fossils being the small incisors, the somewhat longer canines, the thinner and more compressed cranium, and the eversion of the lower and posterior angles of the lower jaw.

THE DISINTEGRATION OF ROCKS

was the subject of an address by Professor T. Henry Hunt. The change of the rocks in question is a chemical one, which is most obvious in the case of crystaline rocks; the felspar loses its alkalies and part of its silver, being changed into clay, and the hornblende its lime and magnesia, retaining its iron and peroxide. From this results a softening and decay to greater or less depths of the strata, so that, while the beds still retain their arrangement, and are seen to be traversed by veins of quartz and metallic ores, the strata are often so much changed, to depths of one hundred feet or more from the surface, as to be readily removed by the action of the water. This phenomenon is well seen in the crystaline rocks of the Blue Ridge, and not less remarkably in those of Brazil.

According to the speaker, it has been a subaerial process, which has been at work during past ages, when the composition of the atmosphere and the climatic conditions differed from those of today, and when carbonic acid, aided by warmth and moisture, abounded. He connected it with that slow purification of the atmosphere which from very early times has been going on. He thought it probable that the process of decay had gone on with decreasing energy to our own times, though it is now insignificant in its action, owing to changed atmospheric conditions.

THE POPULATION OF THE UNITED STATES

was discussed by Professor E. B. Elliott, in a curious paper in which he described calculations made by taking the differences between the figures as given by the various census, and making suitable interpolations for intervening years. Taking the average of these differences, we find that, had there been no war, the population in 1870 would have been 41,718,000 instead of 35,558,000, showing a loss of fully 3,000,000 people. In 1880, the population would be 54,017,000, but making the same allowance, he estimates now that it will be but 50,858,000. The population for the present year, 1874, is placed at 43,167,000. To statisticians, the table, given for every year from 1780 to 1880, is a very interesting one, as is also a tabular statement giving expenditures of the government *per capita* of the population in periods of four years each. Except during war times, there has been great uniformity, rarely exceeding $2 per head per annum. The highest was during Lincoln's first term, averaging $16.76 gold, and the lowest during Jackson's first term, $1.20·5. The present rate is estimated at $1.69 gold, deducting war influence, or $6 37 counting the same.

Professor W. A. Rogers described the Harvard College system of

SENDING TIME BY TELEGRAPH.

The method consists simply in inserting, into the circuit passing through the clock, an ordinary telegraphic sounder. At every second beat of the pendulum, the circuit is broken and a click of the magnet is heard. By a simple device the clock is made to omit every fifty-eighth second. When one, therefore, wishes to ascertain the error of his time piece, he has only to watch for the omitted break, and the first click thereafter is the exact beginning of a minute as shown by the time clock at the observatory. At every even five minutes, there is an omission of about 25 seconds preceding.

The same speaker, in a paper on the

PROPER MOTION OF ε DRACONIS

in right ascension, stated that he found evidence of an irregular proper motion, the star appearing to complete its revolution in from 40 to 60 years. He also pointed out that no predictions of the plane of this star have been verified by subsequent observations.

Professor Hough described an interesting apparatus for

PRINTING THE DIRECTION OF THE WIND,

as well as the velocity, hourly.

The apparatus for velocity consists of a movement for giving motion to a set of type wheels, which is unlocked for each tenth of a mile of wind. Four brass type arms, on which are engraved the letters N. S. E. W., are placed on the prolongation of the shaft, carrying the type wheels for velocity; and these arms, by means of connecting rods, are attached to the armatures of four electro-magnets. Telegraph wires communicating with the vane shaft and magnets cause one or more of the letters to be elevated for printing whenever the battery current is completed.

By means of a half second pendulum clock, an impression for direction and velocity is made hourly on a slip of paper two inches wide and eight inches in length, as follows:

Time	Direction	Velocity	Time	Direction	Velocity
0	N. E.	342	1	N.	360
2	N. E.	372	3	N. E.	385

The first column is the time, the second the direction, and the third the velocity in miles.

So far as Professor Hough is informed, this is the first and only mechanism for printing the direction and velocity. The total distance traveled by the wind in a day, month, or year is read from the sheet without computation; consequently, the device is eminently labor-saving.

Professor Gill, on the relations of certain genera of *canidæ*, said that the division, into two groups of wolves and red and gray foxes, does not express the true relation of the animals. He cited certain characteristics to prove that all should be united in one group.

Professor Le Conte read a paper on the

REPLACEMENT OF INJURIOUS INSECTS,

and mentioned the replacement of one caterpillar which had become a great nuisance in Philadelphia by another, equally as troublesome. No sooner had the sparrows exterminated the first than the second variety appeared. Its family is *orygia leucostigma*. The birds will not eat it. Having attained its full growth on the tree, it crawls quietly to a neighboring wall or fence, and, fixing its cocoon, undergoes transformation. The remedy against the annoyance is, therefore, very simple. Direct the servants, with stiff brushes, to sweep the cocoons from the walls and fences, and place around the trees to be protected rings of tin plate inclined at an angle. This will give the trees immunity, because the insects are not provided with wings for flight.

Professor C. H. Hitchcock discussed the

PHYSICAL HISTORY OF NEW HAMPSHIRE,

giving a sketch of its growth from the earliest times, when an archipelago existed there, up to the present. The first period was characterized by the formation of porphyritic granite, then came a series of gneisses composing the Mount Washington range of mountains. The Labrador period, the rocks of which are composed of granite and felspar, followed, and then the Huronian formation, of very great thickness, succeeded. The next period was the most extensive, the rocks consisting of mica schist; and the last period shows the area submerged by the ocean in the Helderberg period. It occupied the Connecticut valley to the depth of 1,000 feet.

In a paper on the pottery of the mound builders, Professor Cox drew the conclusion that the art of manufacturing concrete or artificial stone did not originate solely with the ancient Romans, but that it was alike understood by the earliest aborigines of America.

President Barnard delivered a brief address on the

METRIC SYSTEM,

in which he said that it will become the sole system in use by civilized nations before the year 1900. He added that the Metrological Society was urging the change in respect to uniformity—a change of only three tenths of one cent upon the dollar—upon our government. That Society will also urge a metrical international coinage; not for immediate use within our territory, but for convenience in commercial exchanges and to facilitate travelers in all parts of the world. Whether such a coinage would eventually take the place of our usual currency might be safely left to the future.

Professor Elliot, in another paper on the United States government, said that its present borrowing power is 20 per cent superior to that of France, the rates paid by the former being 5 per cent, and those of the latter 6 per cent per annum. Professor Wm. H. Brewer, on the

DISTRIBUTION OF AMERICAN WOODLANDS,

said that the flora of the United States contained over 800 trees. Of these trees about 250 species are somewheres tolerably abundant, about 120 species grow to a tolerably large size, 20 attain a hight of 100 feet, 12 a hight sometimes of over 200, and a few—perhaps 5 or 6—a hight of 300 New England contains 80 or 85 species, of which 50 may reach a hight of 50 feet. The Middle States have about 100 to 105 species of trees, 65 to 67 of which sometimes reach 50 feet in hight. Here were originally very heavy forests. There are still large areas heavily timbered, but the timber for all purposes is unquestionably rapidly diminishing and there is no compensating influence going on for increase. In the southeastern region—that is, extending from Virginia and Florida—we have about 130 species. In each case these form the conspicuous elements of the landscape. Seventy-five attain a hight of 50 feet or more, and about a dozen species a hight of 100 feet. The northwestern region, from Ohio to Minnesota, and north of the Ohio River, is represented by about 105 to 110 species, 68 or 70 of which may reach a hight of 50 feet. That is the district furnishing at present the largest production of sawn lumber within the United States. Michigan alone furnished in 1870, of the 12,750,000 of M. feet, 2,250,000: Wisconsin furnished over 1,000,000—the two States thus producing more than one fourth of the whole yield returned in that year. The southwestern region, extending from Kentucky to Texas and the Gulf, has about 112 to 118 species, 60 or 65 of which attain a hight of 50 feet, which the author also analyzed. West of these last two districts, this treeless belt, extending entirely across the continent from the Gulf of Mexico to the Arctic Ocean, is 350 miles wide in its narrowest part, between latitude 36° and 37°, and 800 miles wide on our northern border. The Rocky Mountain region consists of from 28 to 30 species, but a vastly smaller number making up the timber region. With one single exception, all of the trees within the United States which attain a hight of 200 feet are found in Washington Territory and Oregon. The forests are entirely of cone-bearing trees and the number of species is large, the number of timber trees being very large and their size and value also being great. In Washington Territory, official reports state that the land will produce from 25,000 to 300,000 feet per acre, and that there are vast tracts "that would cover the entire surface with cord wood 10 feet in hight."

Mr. Porter C. Bliss read two papers, one on a classification of the Indian languages of Mexico, and the other relating to marks of ancient civilization in that country.

Referring to the

REVERSION OF THOROUGHBRED ANIMALS,

Professor Brewer said that it is often claimed that, if the care of man be withdrawn, the improved breed will retrace the steps of its ancestry and revert to its original characteristics. For some years Professor Brewer has been investigating this subject by every possible means, and, finding no instances of the alleged "reversion" to be authenticated, he considers that the pernicious notion should be exposed and refuted.

Phosphor-Bronze Axle Bearings.

When two bodies are rubbed against each other (under equal pressure, and at equal velocity), the harder they are, the greater is the amount of heat generated; or on the other hand, the greater the difference of hardness between the two bodies rubbed against each other, the less is the heat produced. In the latter case the harder body is more heated than the softer, if of equal size. If, for instance, glass is rubbed against cork, the heating is as 7 to 1 (the copper being heated seven times hotter than the cork); if copper is rubbed against cork, as 4 to 1.

The ideal of a bearing which would wear little would be one made of the same material as the axle revolving in it, if there had not to be taken into consideration the wearing of the axle itself and the heating. A bearing made of the softest material, in which an axle of the hardest material revolves, would be the ideal of a bearing which does not heat, and does not cut the axle, if the wear of the bearing, and deformation by pressure, etc., had not to be taken into consideration.

In practice the best medium must be found which

1. Does not cut the axle.
2. Wears (in itself) as little as possible, and consequently requires a minimum of lubrication.
3. Does not heat, even in case lubrication should be neglected.
4. Is capable of resisting any possible shock without changing its form, or breaking.

Some railway companies desire to use few bearings, at the expense of many axles and much lubricant—(the consumption of lubricant is always in proportion to the wear of the axle on the bearing)—and therefore use bearings containing from 17 to 20 per cent of tin and 83 to 80 per cent of copper, which alloy, undoubtedly, is too hard, and must attack the axle, as has been shown on many railways. Other railway companies use alloys of lead with more or less antimony, which certainly do not attack the axles, but require much lubricant, and wear out very fast. A great number of railway companies in Germany take refuge in the so-called white metal, which, if of proper composition, appears cheap, but in the long run

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certainly is the most expensive. The alloys of copper, antimony, and tin, or so called white metal,are bad makeshifts, as well as the so called lead composition bearings of lead and antimony; for it is impossible to give these alloys a hardness approaching that of the revolving axle without rendering them brittle. If an alloy is used sufficiently hard to avoid great wear, these bearings will heat much and are very brittle.

On most of the English, Belgian, German,French, and particularly on American railroads, white metal, and especially lead composition, bearings are little used, and this with good reason; for what would become, for instance, of a white metal bearing on an American railroad, where the bearings are subjected not only to heavy loads, but where they have to travel thousands of miles on rails belonging to other companies, and therefore are not much looked after.

Gun metal bearings, alloys of tin and copper, are not often homogeneous, with exception of the alloy of 17 to 18 per cent of copper, which is the most trustworthy alloy of tin and copper. In alloys containing a lower percentage of tin, the latter segregates in the form of tin spots, when the alloy cools slowly. All other compositions in use for bearings, such as 12 to 17 per cent of tin and 88 to 83 per cent of copper, do not make homogeneous bearings, unless they are cast in chill molds, which in practice is impossible. This heterogeneity of gun metal bearings is dangerous, as it produces gripping, and thereby a rapid wear. This specific quality of gun metal bearings (to grip) is theoretically easily explained: In cooling, the softer metal (composed of from 7 to 10 per cent of tin and 93 to 90 per cent of copper), being the less fusible, sets first, forming the skeleton of the bearing; later, the very hard and brittle alloy,containing 17 to 18 per cent of tin and 83 to 82 per cent of copper, sets and fills the pores of the softer skeleton. The particles of the harder alloy are easily torn away by the axle if the bearing is not sufficiently lubricated,and these tear the skeleton composed of the softer alloy; this I have frequently observed atrolling mills where the bearings were not sufficiently lubricated, and where particles in the form of small flakes peel off.

A good bearing which answers all purposes must not be homogeneous, but must consist of a strong and tough skeleton, the hardness of which nearly equals that of the axle, in order to resist shocks without deformation, and the pores of this skeleton must be filled with the soft metal or alloy.

The nearer the hardness of the skelton approaches the hardness of the axle, the better the bearing will resist the pressure or shocks; and the softer the metal filling the pores, the better the bearing is in every respect. Such bearings are now made by melting two or more alloys of different hardness and fusibility together, in such proportions that necessarily a separation into two alloys of definite composition takes place in cooling.

Phosphor-bronze bearings consist of a uniform skeleton of very tough phosphor bronze, the hardness of which may be easily regulated to equal the hardness of the axle, while the pores are filled with a soft alloy of lead and tin.

Such a phosphor bronze bearing may therefore be considered as having its wearing surface composed of a great number of small bearings of very soft metal encased in the tough and strong metal which equals the hardness of the axle; on the planed bearing surface this molecular disposition cannot be detected by the naked eye, but, if examined with a magnifying glass, the truth of the above will at once be seen. Another practical proof can be given by exposing such bearings to a dull red heat, when the soft alloy will sweat out, and the hard, spongy, skeleton-like mass remains.

In this consist the great advantages of phosphor-bronze bearings, which is proved wherever tested; for while the axle partly runs on a very soft metal and thus obviates heating, even if not sufficiently lubricated, the harder part of the bearing, its skeleton, does not allow of wear taking place; and as the hardness is arranged to equal the hardness of the axle, wear is reduced to its very minimum.—*Dr. Charles Kunzel*

Use of Iron instead of Lead Shot in the Rinsing of Bottles.

Lead shot, where so used, often leaves carbonate of lead on the internal surface, and this is apt to be dissolved in the wine or other liquids afterward introduced, with poisonous results; and particles of the shot are sometimes inadvertently left in the bottle. M. Fordos states that clippings of iron wire are a better means of rinsing. They are easily had, and the cleaning is rapid and complete. The iron is attacked by the oxygen of the air, but the ferruginous compound does not attach to the sides of the bottle, and is easily removed in washing. Besides, a little oxidized iron is not injurious to health. M. Fordos further found that the slight traces of iron left had no apparent effect on the color of red wines; it had on white wines but very little; and he thinks it might be better to use clippings of tin for the latter.

Fast Steaming.

One of the finest and fastest steamboats on the Hudson river is the Mary Powell. Recently she made the distance from New York to Piermont, 28 miles, in one hour, while the actual running time to Poughkeepsie, 74½ miles, was 3h. 19m., or at the average rate of 22⅓ miles per hour. Boiler pressure, 37 lbs. The Powell is fitted with the ordinary single vertical cylinder, walking beam engine.

PARASITES.—It is common to note that each species of animal has its own parasites, which can exist only upon creatures which have more or less kinship with their host. Thus the *ascarix mystax*, which torments the domestic cat, is found in all species of *felis*, while the fox, so closely resembling the wolf or the dog, is never troubled with the *tænia senata*, common in the last mentioned animal.

THE VIBRATIONS OF SOLIDS OPTICALLY STUDIED.

Professor Ogden N. Rood, of Columbia College, communicates to the *American Journal of Science and Arts* a new method of ascertaining whether two tuning forks, for example, are in unison, or to determine the difference in the number of vibrations executed by them in a second. A short piece of fine steel wire is attached to each of the forks, and the latter are supported as shown in Fig. 1. The forks

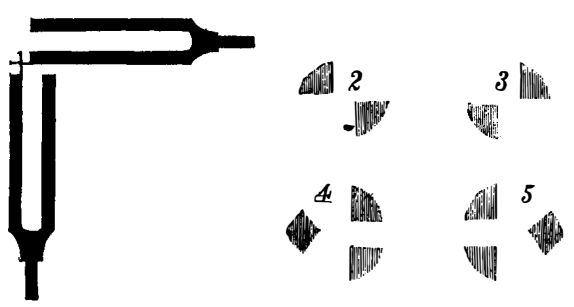

Fig. 1.

are now set in vibration, and the intersection of the wires viewed against a bright background with the aid of a small telescope. When the difference in phase is 0, an appearance like Fig. 2 is produced, which changes to Fig. 3 when the difference in phase has increased to one half a complete vibration. If the forks differ by an interval of an octave, an almost equally distinct figure will be produced, as is seen in Figs. 4 and 5, which represent the characteristic appearances in this case. Somewhat less distinct and more complicated figures are given by the quint, the duodecimo, and the double octave.

It is easy with this method to bring a vibrating string into unison with a given tuning fork, or to adjust it so that the interval shall be a quint, octave,twelfth,or double octave, above or below. It is also easy to ascertain the number of vibrations made by a string in a given case, by the aid of a bridge and a properly selected fork making a known number of vibrations, the string being shortened till it furnishes one of the above mentioned figures, and executes hence a known number of vibrations, after which the number of vibrations made by its whole length can readily be calculated by a well known law.

To bring two cords into unison, or to produce one of the above mentioned intervals, a cork cut at an angle of 45° is placed between the strings on the monochord,and, supported at this angle,is a small piece of looking glass of good quality. The reflected and vertical image of the farther string was then seen in the telescope crossed by the horizontal image of the nearer string; and the mirror being turned so as to reflect,at the same time,light from the sky, all the conditions were fulfilled.

Rods or bars, supported at one extremity or at two nodes, and provided with fine terminal wires, can by this method be brought into unison, or have one of the above mentioned intervals established between them. A preferable mode, however, is to study them in connection with the monochord and a tuning fork. The entire string of the monochord is first brought into unison with a tuning fork, or some definite interval established; the cord and rod or bar are then combined at right angles, and the bridge moved till unison is again effected, when it is possible to calculate the number of vibrations actually executed by the bar or plate. If the fine wire is attached to one side of a bell, the number of vibrations executed by the bell can readily be obtained with the monochord in the manner already indicated.

Vibrating membranes can readily be studied in this way by attaching to them a small piece of fine wire bent with two right angles, and using them in connection with the monochord or a tuning fork.

The more important of these figures may be easily rendered visible to a large audience. Wires about a milimeter thick are attached to two tuning forks placed in front of a magic lantern; an image is formed on the screen with the aid of a lens of about 0·315 inch focal length; the figures are then well shown, along with certain of their details not particularly mentioned in this article.

Great Expositions.

A correspondent of the New York *Tribune* writes from Vienna that the loss of the Austrian government, in its outlays on the recent Great Exposition of 1873, was nine millions of dollars. We have heretofore chronicled the recent suspension of the series of annual World's Expositions, which were inaugurated by the Exhibition Commission in London, and intended to continue until 1876. The losses were so heavy that the Commission was obliged to discontinue them. In view of facts like these, the American people may congratulate themselves that Congress, at its last session, refused to authorize the squandering of public money on the Centennial Exhibition at Philadelphia. The truth is that this Great Exposition business has "played out." It has ceased to be an attraction for the masses, and is chiefly useful for the advertising purposes of enterprizing dealers.

C. H. C. suggests that telegraph companies plant trees on which to hang their wires. "In most sections of the country, the tree first planted would cost but little more than a pole, and after two or three years in growth would be a permanent pole which not rot at the bottom or need resetting, and would be seldom struck by lightning. Having many times seen from three to a dozen poles, in a row, shivered by a charge of electricity running along the wires, the above question arose in my mind."

Pittsburgh Manufacturers for 1873.

Some weeks since, the Pittsburgh *Dispatch* of this city published a list of sales of houses in Pittsburgh doing a business of over $50,000 a year. The list was very imperfect; but as it is so difficult to get statistics in Pittsburgh we have compiled from this list, which was copied from the assessor's list, the items relating to our iron, steel, copper, and glass industries, believing that, imperfect as they are, they will be of value. We do not give the totals of each industry, as this would by no means give the volume of business. We would also say that none of the Allegheny manufacturers are included in this.

In the entire list there are but two houses outside of those connected with the industries given below that did a business of over $1,000,000. As will be seen, three houses in the iron or steel business did above this sum, namely: Jones & Laughlins, J. Painter & Sons, and Hussey, Wells & Co.

IRON.

Graff, Bennett & Co	$914,700	Lloyd & Black	$540.400
J Painter & Sons	1,439,600	Zug & Co	704.690
Chess, Smyth & Co	625.400	Shoenberger & Co	740,000
Jones & Laughlins	2,750,000	Wm. Clark & Co	431 900
Brown & Co.*	793,500	McKnight, Duncan & Co	527,200
Everson, Graff & Macrum	425,000	Dilworth, Porter & Co	393,000

* Including steel.

STEEL.

Singer, Nimick & Co	$879.600	Park, Bro. & Co	$468,500
Anderson & Woods	917,300	Pittsburgh Steel Casting Co	87,500
Hussey, Wells & Co	1,150,000	Miller, Barr & Parkin	589,000

GLASS.

Bryce, Walker & Co	$166,000	Thos. Wightman & Co	$300 000
Campbell, Jones & Co	72,300	Dithridge & Co	152.600
McKee Bros.	230,500	Glass, Nelley & Co	451,400
S. McKee & Co	188,000	Crystal Glass Co	92,600
R. C. Schmertz & Co	112,200	Atterbury & Co	168,800
Duff & Campbell	104,500	Adams & Co	121 800
Excelsior Flint Glass Co	125,900	Bakewell, Pears & Co	150 000
Keystone Flint Glass Co	103.100	Challoner, Hoglan & Co	168,100
Knox, Kim & Co	67,700	Geo. Duncan & Sons	98,500
Jas. B. Lyon & Co	149,400	King, Son & Co	166,300
Wm. McCully & Co	486,100	Dorrington Bros	81,800
Wolfe, Howard & Co	100,000		

MISCELLANEOUS.

Brenneman & Wallack, boilers	$ 53.200
A. Hartupee & Co., engines, etc	326 000
Wm. Miller, forge	140,900
W. G. Price, Sr., foundery	68,600
N. Snyder & Co., boilers	108.800
W. P. Townsend & Co., rivets	135.000
A. Bradley & Co, stoves	74,200
De Haven & Sons, stoves	76,000
Evans, Dalzell & Co., pipes	624 000
W. Graff & Co., pipes	178,400
Jacobus & Nimick Manufacturing Co., novelty goods	173,100
Park & Co., copper	189.300
Graff, Hugus & Co., stoves	150,000
C. G. Hussey & Co., copper	595,000
Mitchell, Stevenson & Co., stoves	175 000
Marshall Bros., machinery	56,000
Bissell & Co., stoves	113,000
A. Garrison & Co., founders	279 600
John B. Herron & Co., stoves	59,400
L. Peterson, Jr. & Co., founders	86 300
Alex. Speer & Sons, plows	150.500
Jos. Marshall & Co., founders	140,000
Dickson, Marshall & Co., founders	78,600
A. French & Co., springs	366,600
McConway, Torley & Co., malleable iron	68,000
Totten & Co., founders	321.100
Schaal, Hoeveler & Co., boilers	93,700
Klein, Logan & Co., tools	60,800
Lewis & Rossiter, founders	90,000

—*American Manufacturer & Iron World*, Pittsburgh.

IMPORTANCE OF ADVERTISING.

The value of advertising is so well understood by old established business firms that a hint to them is unnecessary; but to persons establishing a new business, or having for sale a new article, or wishing to sell a patent, or find a manufacturer to work it: upon such a class, we would impress the importance of advertising. The next thing to be considered is the medium through which to do it.

In this matter, discretion is to be used at first; but experience will soon determine that papers or magazines having the largest circulation, among the class of persons most likely to be interested in the article for sale, will be the cheapest, and bring the quickest returns. To the manufacturer of all kinds of machinery, and to the vendors of any new article in the mechanical line, we believe there is no other source from which the advertiser can get as speedy returns as through the advertising colnmns of the SCIENTIFIC AMERICAN.

We do not make these suggestions merely to increase our advertising patronage, but to direct persons how to increase their own business.

The SCIENTIFIC AMERICAN has a circulation of more than 42,000 copies per week, which is probably greater than the combined circulation of all the other papers of its kind published in the world.

NEW BOOKS AND PUBLICATIONS.

THE AMERICAN GARDEN, a Monthly Illustrated Journal devoted to Garden Art. Edited by James Hogg. Terms $2 a year. Brooklyn, N. Y.: Beach, Son, & Co., 76 Fulton street.

This excellent journal is now in its third year, and the issue for September, 1874, commences a new series. It has been placed under the editorship of Mr. James Hogg, whose renown as a gardener and as a writer on his art, in its many and varied aspects, is widely extended. We predict an extended circulation for this periodical, under the new management.

TITUSVILLE, OIL CITY, AND FRANKLIN DIRECTORY FOR 1874. Compiled by J. H. Lant, Titusville, Pa.

Recent American and Foreign Patents.

Improved Construction of the After Hulls of Yachts, etc.

Empson E. Middleton, Southampton, England.—This invention has for its object to increase the capacity of vessels for carrying cargo or ballast, to enable them to carry more canvas to improve their sailing qualities, and to make them safer in rough weather and in heavy gales of wind. The invention consists in the arrangement of the stern post of yachts and other vessels with its lower end inclined to the rearward at an angle of 45°, more or less, in connection with a corresponding rearward extension of the keel.

Improved Saw Gummer.

Jason W. Mixter, Templeton, Mass.—As gumming machines have been heretofore constructed, the carriage ways are cast on the machine, so that the carriage and cutter cannot be adjusted to alter the direction of the cut; and the cutter being placed upon the end of the shaft, but one journal bearing and but one crank can be used. In the present device, by attaching the carriage and cutter shaft and feed screw to an adjustable "way" frame, the operator is enabled to vary the direction of the cutter so as to cut more toward the center of the saw, if desired. The cutter shaft is supported by an outer bearing on a curved arm. Two cranks may be used instead of one for operating the machine, which may be applied to either straight or circular saws, and without taking the latter from their arbors. The cutter is made detachable, so that it may be changed to adapt it to the diamete or size of the saw.

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Improvement in Securing Knob Roses to Doors.

James Kedey, New York city.—This invention consists in supporting the rose plate by a wooden bush arranged within the lock case. The bush is provided with holes, so that a screw from each rose plate may be inserted, or one from each side.

Improved Guide for Setting Lumber.

Peter Berry, Millerstown, Ohio.—The manner of using the device is as follows: A slab is first cut off from the log in the usual way, the head turning up into a horizontal position as the log advances. The head is then adjusted toward the log beyond the plane of the saw to the extent of the thickness of the board or other form of lumber to be cut from the log. Thereafter, each time a cut is made, the log is adjusted on the head blocks its straight side comes in contact with the head, which thus acts as a or gage. When the log is being fed to the saw, it moves in frictional act with the head. The thickness of cut can be quickly and accurately ed by adjusting the shaft in the bearings.

Improved Egg and Fruit Carrier.

Wendelin Weis, St. Paul, Minn.—Vertical metal bands are fastened to the under side of the bottom, and pass through perforations of the same along stiffening straps to suitable hight, being turned into a right angle at the top to form a lug, for binding over the top or cover. The longitudinal side pieces are provided with strengthening pieces, to which vertical bands with top and bottom hooks are fastened. The top hooks of the bands at one side of the carrier are twisted to extend over the cover in longitudinal direction. The cover is firmly bound to the hook ends at the other side by a pivoted wedge piece, carried under the same, securing thereby the rigid connection of all the detachable pieces when the carrier is filled with eggs. A band spring of the cover acts on a recess of the wedge piece, as soon as the same is placed under the hook ends, so that the wedge piece is secured in locked position.

Improved Fastener for Shade Roller Cords.

Mahault De Penhoel, Fort Snelling, Minn.—Two brackets are attached to a window casing to hold a rod, which is secured to one bracket and passes loosely through the other. Upon the rod is placed a short drum, which is secured by a set screw, which also passes through and serves as a pivot for a pulley, around which the cord passes. By this construction, by slightly loosening the thumb screw, the drum may be moved down upon the rod to tighten the cord, may be moved up to loosen it, or may be turned upon said rod to adjust the pulley to the direction in which the cord is desired to work.

Improved Hat Ironing Machine.

Robert E. Brand, Plainfield, N.J.—This invention consists of a hat-block-supporting disk, which is rotated in horizontal or vertical position by being thrown into gear with a driving shaft. A quadrantal guide mechanism and spring clamp carry the disk into vertical position. The top of the hat and brim are finished by the iron in the former position, the side of the hat being finished in the latter. The hat and hat block are then transferred and adjusted to a second rotating disk, with central aperture, cushion, and spring clamps, for finishing the under side of the brim. The finishing ron is made adjustable in any direction, and at different hights on the top of the supporting frame, and readily used on either side, it being detachable with its supporting frame for the exchange of the heating iron.

Improved Tool Post for Lathes.

Thomas Bonner, Chicopee, and Edward Bonner, Worcester, Mass.—The post is fitted to work up and down without lateral play in a socketed stand, and has a vertical rack in one side, in which an endless worm works, said worm being arranged in bearings attached to the socketed stand, so as to be firmly secured against endwise motion, and so that the worm works through a slot in the stand into the rack.

Improved Fire Place Grate.

John Bawden, Freehold, N. J., assignor to himself and G. Combs, of same place.—By a relative construction in three parts, this gra e may be packed and transported in a small compass, while it may be put together and set up in the fire place with little trouble or expense.

Improved Breech-Loading Fire Arm.

Albert Karutz, Brooklyn, N.Y.—The barrel screws to a receiver at the place for receiving the shell. On the receiver is a casing tube, to which the handle may connect. This tube is capable of sliding on the receiver, and is connected by screws with a crosshead, which is employed to force the needle back to set it for firing the spring. The said crosshead works forward and backward in a mortise, in a tnbe within a receiver, pushing the needle back by its collar, and then, after setting the needle, going forward out of the way of the collar. The receiver has a collar, and on the opposite side a lug, which form a bearing for a sleeve to rest on at its front end, the said sleeve being to lock the inside tube and outside tube in the forward position next to the barrel. At the rear end, said sleeve rests on a sectional collar, forward of lugs on the receiver, and the flange on the front end of the outside tube, which match so as to form a continuous collar when the parts are put together. The sleeve has a flange at the middle of the inside, which is notched so as to pass the lugs of the receiver and lock together with them by turning behind them after so passing beyond them. When the needle is to be set, the sleeve is turned so as to allow screws to pull out of notches, but not so as to allow the sleeve to unlock with the lugs; but when the cartridge chamber is to be opened, the sleeve is turned so as to escape from the lugs and be pulled back with the tube. A spring catch is arranged to arrest the sleeve in the different positions to which it is turned for thus releasing the tube, and also for holding it in the ocking position.

Improved Corn Planter.

George H. Hume, Paola, Kan.—A wave wheel on the main shaft actuates sliding piece, which is thereby carried alternately from right to left, causing the dropping of the seed from the seed boxes in the usual manner. A lever is controlled by the attendant, so that, when the same is thrown forward, a roller is carried back, lowering runners and marking the furrows for the seed. Another roller, brought forward, raises the runners above the ground, for turning the planter from one row into the next, and for going to or from the place of work. To each end of the shaft are firmly applied rotating arms, which strike with their inclined end lugs the pivoted marker rods at both ends of a cross piece. Each lug strikes a rod simultaneously with the dropping of the seed from the adjoining seed box. The rods are carried back into horizontal position after being pressed down by band springs. The end of each marker rod is provided with a check, which leaves an impression on the surface of the ground after each stroke. By suitable devices for throwing the mechanism into or out of gear, the seed-dropping and row-making operation is interrupted and resumed at the will of the attendant.

Improved Gun Lock.

James Madison Grisham, Towash, Tex.—One end of the main spring is nserted in a hole in the rear end of the lock plate, and has a point formed upon it, which projects to serve as a dowel pin for receiving the rear end of the said lock plate in place.

Improved Compound for Dental Impressions.

Benjamin H. Teague, Aiken, and Horace Parker, Edgefield, S. C.—This nvention is a compound for taking dental impressions, consisting of plaster of Paris, gold mine sand, sulphate of potash, and carmine, or other coloring matter, mixed in proper proportions. It hardens quickly, and may be removed sooner than plaster from the mouth of the patient, allowing also, on account of its friability, the breaking away of parts of the impression and their accurate replacing, so that a perfect cast of the mouth is obtained.

Improved Hinge.

Moses L. Poirier, Green Bay, Wis.—This invention consists in a peculiar onstruction for securing the cap piece of the pintle, so that it must be urned on the latter before it can be removed. The inclined lower edge of he connecting plate of the sleeve on the gate passes along the curved edge of a lower socket part on opening the gate, and slides back thereon by the weight of the same till it arrives at the lowermost point. The gate thereby self-closing, whether thrown open in either direction, as the ymmetrically inclined socket edge carries the same back toward the cener point and retains it therein.

Improved Temporary Binder.

James Bennet, St. John's, Canada.—This invention consists in a file which opens and closes upon the principle of the parallel ruler. Pins are attached to the bed piece, so as to stand firm and rigid. Recesses are made in the bed to admit disks under a metallic strip, and disks are placed on top of the strip. Screw threads are cut on the pins, and the disks serve as screw nuts, into the center of which the pins are screwed, one disk nut being below and one above the strip for each pin. The screw threads are cut the whole length of the pins, and the roughened surface thus produced prevents the papers from too easily slipping up when the clamp is raised. Mortises through the clamp receive the pins when the clamp is pressed down in filing. When the clamp is raised for filing, bars serve as guides for the edge of the paper, so that the back edges of the papers filed present an even and uniform appearance.

Improved Adding Machine.

Charles C. Moore and Jacob B. Moore, New York city.—This is an improved adding machine, so constructed as to carry accurately whatever number of wheels be used, bringing each wheel exactly to the required point and leaving it there, and which shall have no lost motion from the imperfection of gearing teeth. In a plate a number of counting wheels are arranged, in which, near the circumference, is formed a circle of ten holes, to receive the point of an instrument for turning said wheels. In the face of the wheels, just within the circle of holes, and concentric therewith, is formed a circle of numbers, consisting of the nine digits and the cipher. Upon the faces of the wheels is formed a second circle of numbers, consisting of the nine digits and the cipher, and so arranged that each number of the inner circle may be the complement of the number of the outer circle. The wheels are so covered that only one number of each circle will be seen at a time, and these will always be the complements of each other, so that the number seen through one hole will always indicate through the space of how many holes the wheels will have to be turned to bring the wheels to the 0 point. In using the machine, the instrument is inserted in the hole of the wheel opposite the digit of the scale that represents the number to be added, and is moved around to the right until it strikes a stop. The units, tens, hundreds, etc., are added by turning the proper wheels. In turning either of the wheels, as each ten of the column of figures being added is reached, the next wheel is turned one space, the carrying being thus done automatically. The wheels are kept from being jarred out of place, or accidentally turned forward or back, by springs. Upon the under side of the main plate are attached ratchet wheels, to a tooth of each of which is pivoted a push rod, of such a length and in such a position that, when the figure of the scale shows through the notch, the forward end of the said push rod may rest against a tooth of the next ratchet wheel, ready to move it one tooth when the first ratchet wheel is again moved. By this construction, as soon as a push rod has pushed the next ratchet wheel through the space of one tooth, it drops away from said wheel, and, as its own ratchet wheel continues to move forward, its movements are so guided as to keep it away from the teeth of the next ratchet wheel until it is time for it again to operate said next wheel, when it moves forward, moves the said wheel one tooth, and again drops away

Improved Explosive Compound.

Charles A. Browne and Isaac S. Browne, North Adams, Mass.—This invention relates to a new priming compound, which is exploded by a current of electricity or the electric spark, when properly secured in an interruption of the electric current. It consists of the mixture of fulminate of mercury with pulverized antimony in various proportions, with an addition of antimonic sulphide or other ingredients, if desired, for producing a greater or less degree of electric conductivity of the priming.

Improvement in Indexing.

Walter Knight, San Andreas, Cal.—The object of this invention is to furnish for bookkeepers, accountants, and others, a neat case for keeping the index of books therein, it being so arranged on the desk that it indicates, without loss of time, the page of the party in the book, and expedites work thereby. The device consists of a case with open top and front part, which carries in side grooves suitable frames with the index tables of the names slid therein, said frames being raised by means of levers and keys, exposing thereby the index table required.

Improved Water Elevator for Wells.

William Mason, Providence, R. I.—In the inner part of the well spout is pivoted the outer end of a bent arm, the inner end of which projects sufficiently to catch upon the edge of the bucket as it rises above the spout and till it discharges the water automatically into said spout. Upon the lower side of the inner end of the arm is pivoted a small friction wheel which, should the bucket rise so that the arm catches upon the edge, near one end of the bail, may roll along said edge to a position midway between the ends of the said bail, so as to discharge the water properly into the spout.

Improved Ordnance and Methods of Constructing the Same.

Percival M. Parsons, Blackheath, Eng.—These improvements in ordnance relate, first, to the mode of manufacturing the inner tube of the gun, whereby the fibers of the metal are arranged spirally, and the capacity of resistance to strains greatly increased. The ingot of steel is first cast as usual. It is then drawn down, by hammering or otherwise, until it approaches the finished size. The ingot is then brought to a suitable heat in a furnace, and is twisted a sufficient number of times, which is accomplished by fixing one end in a box attached to an axle, which is made to revolve in suitable bearings, while the other end is griped and held stationary in fixed jaws, or turned in the opposite direction. It is then rehammered, and, if necessary, the operations may be repeated. The improvement also relates to the method of constructing steel lining tubes for guns, intended for insertion into smooth bore cast iron guns for the purpose of converting them into rifled guns, or into a cast iron casting for the purpose of making new guns. A number of separate hoops of convenient width, formed by hammering or rolling or by both operations, are combined in such a manner that the diameter of the ring is increased during the operation, and the metal is thereby extended or drawn out circumferentially, and the fibers and any lines of weakness developed by flaws in the original casting are placed in a circumferential direction. The inner tube having been turned to the requisite size, a sufficient number of these rings bored to the requisite size are forced on its breech end side by side, to form the rëenforce tube. These are then turned, leaving bands at their edges of slightly larger diameter than the intermediate portion between them. Another series of rings of the requisite size, in relation to the first series, are bored out, with an annular recess in each corresponding to a pair of bands of two adjacent rings of the first series; this second series of rings are then expanded by heat, and placed over the first series in such a position that they will break joint with them, and so that the bands or fillets formed on the edges of the first series will fit into the annular recesses formed in the second series, by which means the rings will be connected longitudinally, and form in effect a continuous tube, and may be treated as such to impart longitudinal strength to the inner tube. The improvements relate likewise to the form of the breech end of the lining tube and the interior of the cast iron casing into which it is fitted, and the general combination of the parts in guns of this description. In guns hitherto constructed on this system, the breech end of the lining tube, where the rëenforce occurs, and the recess made in the breech end of the casing to receive it, have been made conical, which form requires special machinery to bore out the casing, and offers difficulties to the proper fitting of the tube. The breech end of the tube is made cylindrical, and reduced in diameter in steps toward the muzzle, as required, and the interior of the casing is made in a corresponding form. The tube is inserted into the cast iron casing at the breech end, and is secured by a breech screw, in combination with which a nut is screwed to the end of the inner tube let into a recess bored out of the muzze end of the cast iron casing.

Improved Bolt for Middlings Purifiers.

Joseph W. Wilson, Warsaw, Ill.—By this invention, middlings purifiers that use a flat screen are provided with a bolt, so constructed as to keep the screen cloth clean, and the middlings thoroughly agitated, increasing the capacity of the bolt or screen, and enabling a much finer screen cloth to be used.

Improved Car Coupling.

Gabriel Thomas, Reno, Nev.—A small plate is attached near the lower end to the back of the coupling pin. A spiral spring is placed in a recess behind the pin, which bears downward on the plate with a constant pressure, and reacts against a shoulder to throw the pin downward. A vertical bracket spring is attached to the under side of the drawhead, extending up through the link opening, with its end under the plate, so that it will naturally support the pin when the latter is raised. When the cars come in contact with each other, the end of the link strikes this spring, and pushes it from the plate, and the pin is forced down through the link. For uncoupling the cars, the pin is raised by means of a bell crank which connects with a rod which extends laterally to the side of the car. This rod has a series of ratchet teeth which catch on a plate through which the rod passes by which means the pin may be held up without the supporting spring. A similarly arranged rod extends to the top of the car.

Improvement in Refining Sugar.

A. H. William Schrader, Hoboken, N. J.—This invention consists in subjecting raw sugar when suitably moistened to the action of a very high degree of pressure acting from above on its surface, so that the compressed air percolates between the granules of the sugar and effects the bleaching and purging of the sugar previous to its dissolution. The invention consists, further, in the dissolution of the sugar in the same tank under the admission of steam and water for the purpose of repeating and completing the purification, or drawing it off for passing through the filtering and discoloring operations to be returned and purged completely, and finally dried.

Improved Steam Radiator.

James McCarthy, New York city.—The base of the radiator is made hollow, and on its upper side are formed openings, which form sockets to receive the ends of the tubes. The head of the radiator is also hollow, and receives the upper ends of the tubes. Rods pass through the tubes, enter the cavity of the head, and have eyes to receive other rods, which are passed through them. By this arrangement the rods and their supporting rods will not impede the passage of steam through the tubes. The washers in the tube sockets are hollow rings open upon their inner side, and are spun up out of ring plates of sheet metal. The washers thus constructed will yield sufficiently to pack the ends of the tubes steam-tight. With this construction the steam will circulate quickly and uniformly through all parts of the radiator, so that the radiator will heat up evenly in all its parts.

Improved Seal Lock.

John S. Lorimer, Detroit, Mich.—An inner removable plate is fastened to the back plate by a screw. A sliding bolt is thrown forward, to engage with the notch of the hasp, by a spring. A small knob on the bolt projects into an orifice of the inner plate. The seal plate is made preferably of glass, upon the back side of which is the railroad label. This slides in through a slit in the edge of the lock, and covers the inner plate, and consequently the knob of the bolt. The hasp is not hinged, but slides in and out, a shoulder on a long leg preventing its being entirely separated from the lock. When the hasp is down, the long leg entirely closes the slit, and effectually confines the plate, so that the seal plate must be broken before the lock can be unlocked.

Improved Machine or Cutting Clothes Pins.

Henry Mellish, Walpole, N. H., assignor to Wyman Flint and George H. Mellish, Bellows Falls, Vt.—The object of this invention is to rapidly cut bifurcated clothes pins of any kind, but more especially the kind described in letters patent granted to same inventor, dated September 23, 1873, No. 143,024, by the combination of a stationary channel or groove, in which to alternately move and hold the timber, by means of feed wheels and a holding plate, while the pins are being cut. When the feed ceases and the piece of wood is stationary, and the cutters ready to work, this plate is dipped by a cam, which strikes a riband raises a plate, so that its other end presses on the wood in the groove and holds it down, to prevent splitting while it is being cut. This cam is so formed and arranged that the pressure is continued while the cutters are at work, and discontinued when they are withdrawn. For making the openings, the cutters penetrate half way through the piece as the lathe is passed through this machine. The next machine cuts the other side in the same manner, and then the piece of wood is split, which separates and completes the pins. Another cutter cuts into the piece to give the length of the pin. The cuts in the two sides of the piece are not opposite each other, so that the piece holds together until it is split to separate the pins.

Improved Lamp Cooking Apparatus.

John A. Miller, New Orleans, La.—A common petroleum lamp has its chimney provided with a closely fitting shell of sheet metal, which extends from the neck to the upper rim, and prevents its unequal expansion. The shell also serves to a certain extent to retain the heat in its passage through the chimney. The cooking vessels proper consist of a boiler and several additional vessels, which are fitted into each other and into the boiler, each forming a separate cooking chamber. The boiler is arranged at the bottom with worm-shaped channels, which take up the flame from the chimney and conduct it around the bottom and sides. A convex perforated bottom, loose or false, is placed on the boiler bottom to prevent the articles cooking therein from burning. The vessels are connected by steam tubes, which are arranged at opposite sides to compel the steam to spread under the bottom in passing to the next vessel.

Improved Adjustable Ferrule for Agricultural Implements.

William H. Bowman, London, Ohio.—The ferrule is made of two halves, which fit symmetrically over the handle end. When the handle shrinks, the ferrule is tightened by driving up a band. The band takes hold of the outer side of a tongue simultaneously with the ferrule halves, as it forms, on account of an inclined groove and its inner wedge shape, part of the circumference of the ferrule. The lug locks the tongue securely to the ferrule.

Improved Water Wheel.

Marquis D. Grow, Dubuque, Iowa.—The buckets are made straight and radial, and are formed upon or attached to the body of the wheel. The discharges extend rearward from the lower ends of the buckets, and are curved downward, so as to be convex upon their upper side, as shown. They are surrounded by a band, attached to their outer edges, and the upper edge of which rests against a shoulder formed by the thickening of the case for the chutes, so that the water from said chutes may be discharged directly against the buckets. To the top of the gate is bolted a ring, which fits around the edge of a cap plate in which the shaft revolves. To the cap are pivoted at their angles two elbow levers, the arms of which have short slots formed in them to receive pins attached to the ring. To the other arms of the levers, near their outer ends, are pivoted the ends of a connecting bar, so that the levers may operate together upon the opposite parts of the ring to move the gate. Upon the lower part of the outer side of the gate is formed a flange, upon which rests the outer gate, which has a flange, formed upon the lower part of its outer side, in one part of which are formed teeth, into which is geared a governor, so that the gate may be adjusted automatically to regulate the ingress of the water by the motion of the wheel.

Improved Pocketbook.

Gabriel Jasmagy, Brooklyn, N. Y.—The object of this invention is to improve the pocketbook patented by same inventor under date of April 28, 1874. It consists of a pocketbook, the partitions of which are connected, without stitching, by a lining made of a blank which extends continuously over the same, and is cut with sector-shaped side flaps for forming the side connection of the partitions, and also with the side flaps of the pocketbook. The invention consists, further, in the arrangement of a billbook formed as extension of the partition covering, and folding out of sight into a section of the same.

Improved Beam End Protector.

Norman McLellan, New York city.—The invention relates to a sheet tin casing for the ends of wooden beams as a protection against the influence of dampness or destruction by fire. The casing covers the beam end and so much of the contiguous portion as enters the mortise in the brick or stone wall, and it may also be made of sufficient length to project a short distance from the side of the wall.

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Business and Personal.

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Users of Baling Presses, address V. Pugsly, N.Y.

Millstone Dressing Diamond Machines—Simple, effective, economical and durable, giving universal satisfaction. J. Dickinson, 64 Nassau St., N.Y.

Engines 2 to 8 H.P. N. Twiss, New Haven, Ct.

English Patent for Sale or to Let on Royalty. Article made by Machinery very fast. Used in every family in the land. Entirely new and novel. Extensively manufactured and sold in the U. S. Sample sent by mail, and full particulars given on application to the inventor and sole owner of Patent, Charles G. Cole, Bennington, Vermont.

Wanted—A Partner with $8,000 to $12,000, in manufacturing a Patented article. Address G. Schumann. Zabriski St, Jersey City Heights, N. J.

A thorough Machinist and Draughtsman, an experienced Foreman, desires employment. Address Edward Clinton, Philadelphia, Pa.

For Sale—Good Machine Shop and Foundry Business, with Lease. Tools new and first class. Location and buildings very desirable. Terms easy. Address Toledo Machine Co., Toledo, Ohio.

Experience and Capital want employment in Foundry and Machine Business. Address Drawer 57, Catskill, N. Y.

For Sale—Two Steam Saw Mills and three Farms, by C. Bridgman, St. Cloud, Minn.

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Forges—(Fan Blast), Portable and Stationary. Keystone Portable Forge Co., Philadelphia, Pa.

The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers, signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price $5. F. C. Beach & Co., 263 Broadway, New York, Makers. Send for free illustrated Catalogue.

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Price only three dollars—The Tom Thumb Electric Telegraph. A compact working Telegraph apparatus, for sending messages, making magnets, the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key and wires. Neatly packed and sent to all parts of the world on receipt of price. F. C. Beach & Co., 263 Broadway, New York.

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For Surface Planers, small size, and for Box Corner Grooving Machines, send to A. Davis, Lowell, Mass.

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Automatic Wire Rope R. R. conveys Coal Ore, &c., without Trestle Work. No. 34 Dey street, N. Y

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Best Philadelphia Oak Belting and Monitor Stitched. C. W. Arny, Manufacturer, 301 & 303 Cherry St., Philadelphia, Pa. Send for new circular.

Buy Boult's Paneling, Moulding, and Dovetailing Machine. Send for circular and sample of work. B. C. Mach'y Co., Battle Creek, Mich.. Box 227.

ANSWERS TO CORRESPONDENTS

P. D. R. and several other correspondents will find full descriptions of lightning rods on the editorial pages of this issue.—H. D. E. will find directions for making an æolian harp on p. 330, vol. 26.—S. H. C. will find explicit directions for bronzing iron castings on p. 107, vol. 30.—G. M. E. will find directions for making asphalt pavement on p. 353, vol. 24.

G. W. B asks: How can I polish meerschaum? A. Soak first in molten tallow, then in molten white wax, and then rub with a dry rag.

W. C. D. asks: Is there any difficulty in using a coiled pipe, of 1½ or 2 inches diameter, as a water heater in a furnace? The fire pot is 30 inches in diameter; and I want to use from 10 to 15 turns or coils of pipe placed within the fire pot, the pipe passing out and connecting with a hot water radiator in an air chamber outside, the water passing back from radiator and entering bottom of coil, so as to keep up a continuous circulation. I am told that steam will form at points in the coil and choke the pipe, preventing a free and steady circulation. Is this so? What size of pipe ought I to use, and what is the best form of hot water radiator? Is there anything better than a simple manifold of plain pipe? A. A much larger pipe will be necessary to enable you to secure circulation with the arrangement that you propose. The manifold will answer very well for the hot water radiator.

B. B. B. asks: In a three mile boat race, would it take any longer to turn a stake boat at the end of the first mile and a half and return, than it would to row the three miles straight ahead? A. Yes.

J. G. asks: In what part of the world was the Garden of Eden? A. No one knows.

If the earth goes round on its axis, why do we not get to the part where there is no frost or snow, or to the part where there is no summer? A. If you will consult any elementary work on astronomy, you will readily perceive the reason.

Is there anything produced that will keep coal dust cemented together so that it will stand burning to ashes before it will part? A. There are numerous patents for this purpose, many of which have been described in the SCIENTIFIC AMERICAN.

J. H. K. asks: I am engaged in an experiment that requires the use of a series of small bellows. It will be necessary they should be absolutely airtight, and, as they will be exposed (probably) to water, it is equally important they should be waterproof. Will you tell me what material to use, and how to construct them to gain these ends? Will gum cloth answer? If so, how shall I fasten it to the heads, and should those heads be of wood or leather? A. We think you can obtain rubber bottles or syringes that will be cheaper and more satisfactory than the arrangement that you propose.

W. S. P. asks: If a piston were let fall 25 feet in such a manner that it would enter an airtight cylinder, would the sudden compression heat the air within the cylinder? If so, would the expansion of that heated air be great enough to throw the piston as high as the point it fell from? A. There would be some power consumed in overcoming friction, and some of the heat of compression would be dissipated, so that the useful effect would not be as great as the power exerted.

What would be the pressure of air per square inch on the inside of a hollow casting one foot square, it being heated to a red heat after being filled with cold air at atmospheric pressure? A. Professer Thurston has published a table of the temperatures and pressures of air. You can obtain it from D. Van Nostrand. Your other question is of a business character.

W. S. F. asks: When is the transit of Venus to take place? When was the last? When will be the next, or how often do such phenomena occur? A. Transits of Venus always take place in June or December. There are two transits, eight years apart, and then more than a century elapses, after which there are two more transits, eight years apart. A transit was predicted by Kepler, in 1631, but was not observed. The transit of 1639 was observed by Horrox and Crabtree, in England. The last two transits occurred on June 6, 1761, and June 4, 1769, the latter being observed from various stations, widely separated. The next transit will take place on December 9, 1874, and preparations have been made for very complete observations. The last transit during the present century will occur on December 6, 1882.

J. T. B. says: I have moved into a large frame house, which rests upon pillars four feet high, with lattice work between them, so that there is a free circulation of air; the house is lathed and plastered throughout; yet, in a few days, articles of clothing, shoes, etc., will mold if put in the closets. Please tell me the cause, and if there is a remedy for it. A. A succession of rains and damp weather will sometimes produce moldiness in closets, but in your case it is caused most probably by the fresh plastering of the house. Plaster absorbs moisture from the atmosphere for some time after it is put on, and under certain conditions of temperature will give it off in large drops and streams. It is for this reason that new walls cannot be safely painted. We remember a case in point, where the newly plastered walls of the class rooms in a school building were painted and their surfaces prepared artificially to serve as slate, to be used for writing upon in place of the ordinary blackboards. They were finished very handsomely, and the imitation was perfect; but in one week's time the paint began to run in such streams as to trickle down across the white base, and lie in black puddles on the floor. Your remedy is to keep your closets open, and let the wind blow through the house in the middle of the day.

H. A. W. says: You have been calling attention to the importance of educating the left side of the body and brain. Is it not a fact that more persons are paralyzed on the right side than the left, and may it not be accounted for by the fact that the right side is overtaxed by giving it too large a proportion of the work to be done? A. You evidently have forgotten that the left side of the brain is the index of the right side of the body. If you maintain that the left side of the brain and left side of the body are both paralyzed, it would show that the whole system was under that influence, the nervous force on the right side and the muscular system on the left side being the sufferers.

D. C. P. asks: Which will use the most coal, two high pressure engines, compounded, 12x8 inches, each cut off at half stroke, with 70 lbs. steam, with 150 revolutions per minute geared to a main shaft, its pinion being 24 inches in diameter, and the engine's pinion 12 inches: or a low pressure condensing engine, of dimensions equal to the task, with a good generator? A. The second would be the most economical, with the same grade of expansion as the first.

Where could I learn the millwright's trade? A. There are numerous good shops scattered over the country. It would be well for you to enter one of them as an apprentice, or in such capacity as you could arrange with the proprietor.

How can any one enter the Bureau of Steam Engineering at Washington? We do not understand exactly what position you want. Write your wishes definitely to the Chief of the Bureau of Steam Engineering, and you will probably obtain a reply. If there is still a difficulty, you might address the Member of Congress from your district.

C. C. A.—The instrument you describe is simply a pneumatic syringe. It is not a novelty, having been shown in courses of experiments, under the subject of heat, in our schools for years.

J. A. H. asks: Why does a glass bottle burst, when you expose it to the air and lay it on red hot coals? A. It is owing to the unequal expansion of the glass when placed upon the coals.

What is the telescope principle used for? A. Your question is very indefinite. The telescope is composed of several lenses so arranged as to bring at the point of sight, objects magnified several diameters. Consult an elementary text book upon optics.

H. S. asks: My finger nails are very brittle, in fact, the least pressure causes them to break. Is there any remedy? If so, what is it? A. Bathe the nails with oil; glycerin will not answer; keep the nails cut close. If very sore, you must keep them bathed continually.

J. M. B. says: Please give a formula for calculating the proper dimensions of a fly wheel, dimensions and speed of engine being known. A. You will find rules on the subject on pp. 177 and 288, vol. 28.

J. W. M.—Your idea for an electro-magnetic engine is not a new one, and is impracticable, little or nothing being gained by its use; and instead of replacing the battery, you only lessen the reliability by complicating its machinery.

E. H. H. asks: Is there any machinery for cutting files in use, that is working successfully, and what has been the principal trouble with machine-cut files? A. There are several of such machines, machine-cut files being in common use. They are not, however, equal to hand-cut files, either in the regularity of the cut or in the quality of the cutting edge of the teeth.

G. S. asks: How can I harden thin brass wire, about the thickness of a common sewing needle or a pin, so as to make a spiral spring, by winding it over a mandrel the thickness of a common penholder? A. Harden your brass wire by hammering it lightly while it is on the mandrel after it has been wound.

What kind of glue can I use to glue thick leather on wooden rollers about an inch in diameter? A. Any kind of superior glue.

To what color must I heat a watch spring to temper it, and must it not be well hardened before tempering? A. To harden such a spring, heat it to a red heat and immerse it in oil till cold. Then fry it in equal parts of oil and tallow until the mixture will blaze on the spring. When the mixture blazes, keep dipping the spring into it, and then holding it in the flame so that the spring will blaze of itself when held away from the flame. After blazing freely, allow the spring to cool of itself.

W. G. R. asks: Will immersion in a solution of sulphate of soda be sufficient to test the effects of frost upon a sample of artificial stone? A. We hardly think it will. Try a mixture of ice and salt; this will lower the temperature to —4° Fah.

P. J. H. asks: What is the effect of a daily application of rain water and ammonia to the hair? A. If the solution of ammonia is according to the regular formula, there will be no injurious effects. Inhaling the vapor of ammonia is injurious. It is in no way detrimental to the hair.

N. D. T. asks: Is there any better substance for removing the organic impurities from cistern (rain) water than the permanganate of potash? If not, what amount should be used in purifying a tun of water, and what manipulations are required? A. Sulphate of alumina is used to purify water. If you use permanganate of potash, 4 tablespoonfuls of a saturated solution of the permanganate will be found sufficient for one tun of water; if the water retains a pink hue, put a stick or chip in it, when the color will shortly disappear. You will find a new method fully treated on page 414, *Science Record*, 1874.

D. W. S. asks: 1. Will the copper lightning rod on my house injure the water in the well in which it terminates? A. Yes. 2. The galvanized rod on my barn terminates in a half hogshead of running water. Is it safe? No. 3. Would it be safer if it penetrated the ground eight feet? A. Yes, and it would be still safer if you deposited a cart load or more of well burned charcoal at the bottom of the rod, surrounding the rod for a length of several feet with the charcoal.

C. M. asks: In your issue of July 18, in answer to D. Q. C., you have not stated how much niter is to be used. A. In formula mentioned, niter is 10 parts.

What is meant by smalt? A. Smalt is pulverized cobalt glass.

What is peroxide of lead, and is it known by any more common name? A. Peroxide of lead is a heavy brown powder consisting of oxygen and lead.

Is anything mixed with the sulphur in which matches are dipped, to thin it? A. No.

J. E. S. asks: Is it a fact that the water 150 miles from the mouth of the Amazon river is suitable for drinking, or does it mix with the ocean and become brackish or salt? A. It is brackish.

What number of emery and what grade is most suitable for grinding molding tools? I make my tools on emery wheels from blanks made as planer knives are, that is, with steel faces and iron backing; and I find that wheels that manufacturers recommend are all right to cut the steel, but the iron will glaze the wheels. I want them for fast cutting. A. We advise you to consult a reliable dealer.

What would be the actual horse power of a locomotive, with two 18x26 inch cylinders, at 130 lbs. per inch, and 4 feet 6 inch drivers, making 20 miles per hour? A. The mean effective pressure of steam in cylinders is required for the solution of this problem.

G. G. McC. asks: What degree of heat is necessary for the incubation or hatching of the egg of the common barn yard fowl? A. From 102° to 104° Fah.

J. P. A. asks: What is pip among chickens? Is it injurious to the fowls? What is the hard substance on the end of chickens' tongues? A. "The pip by some is considered a catarrhal disease producing a thickened state of the membrane lining the nostrils mouth, and tongue; others consider that the disorder originates in a small vesicle formed on the tip of the tongue, the contents of which, being absorbed, lead to the inflammation and the thickening of the skin. The common and well known symptom is a white scale o horny substance growing upon the tip of the tongue, by which the breathing becomes partly impeded; the beak is frequently held open as if gasping for breath, and becomes yellow at its base, while the feathers on the head appear ruffled or disordered. The tongue is also very dry; and while the appetite is not much impaired, the disordered fowl can eat only with considerable difficulty, and sits in corners, pining away. The most effectua cure we have ever employed, and that, when the disease has not proceeded too far, was to tear off the scale with the nails of our forefinger and thumb; and it is not difficult, as it is not adhesive; and then Boswell recommends to fill the mouth and push down the throat a large lump of fresh butter, which has previously been well mixed with Scotch snuff. 'This,' says Boswell, 'is a recipe which we conscientiously and confidently recommend; and again we beg to repeat, that, in our experience, we have never known it to fail, except from our own negligence in the delay of its application.'"—*American Poulterer's Companion.*

E. A. F. T. says: I have constructed a galvanic battery as follows: One cup of copper, 8 inches high and 6 inches in diameter, is made of very thick sheet copper. This vessel I charge with 1 part sulphuric acid to 10 parts of water. Then I insert a glass cylinder (3 inches in diameter), closed at the lower end with blotting paper. In this I insert a cylinder of rolled up sheet zinc, 1½ inches diameter, and charge it with 1 part of muriatic acid and 10 parts water. The battery works very well for silver plating; would it also do for nickel plating? A. Several cells of this description may be used for nickel as well as silver plating on a small scale.

How should nickel salts be prepared for plating? A. You will find a recipe on p. 51, vol. 30.

C. W. G. says: I have discovered (near the waters of Hickory Creek, Texas), some bones of enormous size; they were cropping out of the bank. One bone measured 27 inches in circumference, 1¼ inches from surface of bone to the marrow. One of the upper jaw teeth measured 11 inches in length and 4½ inches in width. The side of the jaw from which these teeth were taken weighed 25 lbs., the teeth being, seemingly all connected together. About 5½ feet away, I found the rest of the upper jaw, somewhat decomposed, though the teeth were in a good state of preservation. Can you give me the name from this description? A. No. We might, if you sent on some of the teeth. If you can obtain more data in regard to the size of the skeleton, length of body, legs, neck, etc., we might be able to answer you fully.

M. E. P. says: Please inform me how to prepare pickles so that they will keep good and retain their green color? A. Small cucumbers, but not too young, are wiped clean with a dry cloth, put into a jar, and boiling vinegar, with a handful of salt, poured on them. Boil up the vinegar every three days, and pour it on them, till they become green; then add ginger and pepper, and tie them up close for use. A permanent green color cannot be obtained without the presence of copper, and pickles so prepared are injurious.

What will prevent insects from eating wall paper? A. You do not state what the insects are. Some can only be driven away by putting poison in the paste when putting the paper on the wall.

How can I preserve citron to have it like the dried citron we buy? A. Take citron and sugar, pound for pound, and simmer until tender. Allow to dry in the sun, keeping it covered with sirup during the process.

C. C. M., Jr., says: I have just completed an electric machine, but it will not work, although every thing appears to be in good order. Rubbers are made of wood and chamois skin, covered or coated well with amalgam of mercury, zinc, and tin. The prime conductor is made of insulated wood, covered with tin foil which acts or should act as a good conductor of the electricity, if any were developed. The negative conductor is not insulated as most are, but is made of wood connected with the base. Perhaps I may have made a mistake in making the machine as I did. If so, you will greatly oblige me by stating it. The glass is insulated from the atmosphere by oiled silk. A. Your negative conductor, namely, the chain attached to the rubbers should be placed in connection with the earth, if the positive fluid is desired; and if the negative spark is required, the chain should be placed in connection with the prime conductor and the earth. One of the conductors must always be in connection with the earth otherwise the machine will not work.

A. C. H. asks: 1. A tank full of water has 4 outlets. If *a* is open, it takes 15 minutes to empty the tank, *b* 30, *c* 45, and *d* 60. How long will it take if all four are opened at once? A. It will take about 7½ minutes. 2. Has the amount of water anything to do with pressure of the different sizes? A. Under the same pressure, a large tube will discharge more water proportionally than a small tube.

Which is the real American eagle, the one with a white head, or a brown one? A. The one with a white head commonly called the bald eagle.

How can I prepare leaves of plants so as to leave the veins only, all the soft green mass being taken off? A. Put them in water and allow to stand until the parts desired to be removed are nearly decomposed. The length of time will depend upon the kind of plant. Remove the desired parts with a camel's hair brush and dry in sheets of blotting paper. Then bleach by a preparation sold in the market for the purpose. If this cannot be obtained, use chloride of lime.

What is osmic acid? A. "The tetroxide of osmium OsO_4, commonly called osmic acid, is the volatile strong smelling compound formed when osmium or either of its lower oxides is heated in the air, or treated with nitric or nitro-muriatic acid. It may be prepared by heating osmium in a current of oxygen gas, and condenses in the cool part of the apparatus in colorless transparent crystals. It melts below 212° Fah., and boils at a temperature a little above its melting point Its vapor has an intolerably pungent odor: attacks the eyes strongly and painfully, and is excessively poisonous. Osmic acid is dissolved slowly, but in considerable quantity, by water, forming an acid solution. It is a powerful oxidizing agent, decolorizing indigo solution, separating iodine from potassium iodide, converting alcohol into aldehyde and acetic acid," etc. (Fowne's "Chemistry.") Recently some osmic acid was presented to the French Academy; though but a small amount, it was calculated that it was enough to poison the whole world.

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J. W. H. asks: If the exhaust steam from an engine contains ¼ of the entire units of heat used in generating it, would it not be practical and economical to pump it back into the boiler? Is this idea new or old? A. The idea is neither novel nor good.

G. F. R. asks: How can I bend brass tubing without injury to the tube? A. Fill the tube with resin or with lead, before bending, and melt the same out after the bending is completed. Lead is the best.

H. Z. E. asks: 1. What is an accurate second of time, and how is it determined? A. 1. You will find table below, upon which to base your calculations. 2. Is it a natural, or artificial unit of measure? A. 2. Artificial. 3. What proportion does the ordinary yard bear to the length of a pendulum beating seconds? A. 3. The length of the seconds pendulum—that is to say, of the pendulum which makes one oscillation per second—varies, of course, with the intensity of gravity; at the level of the sea it is, according to Sabine: 39·02074 inches at the equator (St. Thomas), 39.13983 inches at London, and 39.21469 inches at Spitzbergen.

What is meant by the molecular theory of matter? A. The molecule is the smallest quantity of any elementary substance which is capable of existing in a separate form. H, for instance, represents the atom of hydrogen, while HH, or H2, indicates its molecule.

How does the greenback paper dollar compare with specie, as a measure of value? A. Specie is worth about 9½ cents more on the dollar than paper, but its comparative value is constantly varying.

W. S. P. asks: Has the hatching of hen's eggs by artificial heat ever been a success? If so, when, where, and by what process? A. Artificial incubation s considerably practiced. You may see the apparatus in operation at agricultural and industrial exhibitions.

F. B—For cleaning the ink (containing iron) from your blanks, try a strong solution of caustic potash.

W. B. asks: How much does pure water weigh to the cubic foot? A. Pure water weighs 1,000 ounces per cubic foot.

Will not water drive an engine as well as steam or compressed air, if supplied through a suitable pipe from a reservoir 50 feet above the engine? A. Water will drive an engine, but not so well as steam or compressed air, because of the difficulty of getting the water into and out from the cylinder with sufficient rapidity. Power from water is best utilized by means of a water wheel.

I propose to use a friction arrangement, consisting of a smooth bar, with a dog on each side to clamp the bar, and to have springs to keep the dogs on the bar. Will it work accurately? A. Your friction arrangement would, if the springs were powerful enough, drive the bar; but it would be liable to spring the bar out of true, if one spring were more rigid than the other, as is very likely to be the case.

I have an attachment for lathes by which the speed of tool travel can be changed without stopping the lathe, and can be changed from any one feed to any other in 15 seconds. It is very simple in its construction. There are two shaves running lengthways of the lathe bed, each having a number of wheels, running from large to small, on the back, on which they are keyed fast, while on the front one they are not keyed. They are thrown into action by means of a gear clamp. The clamp is made double (so as to work both ways), the levers of which (when out of motion) rest in the middle one of three notches; and when in the left hand notch, the feed is, say, 20 to the inch, while, when in the right, it will be, say, 18 to the inch. The front shaft imparts motion to the feed screw, and the back receives its motion from the main spindle, and it can be attached to any lathe. Do you think it is of any value? A. It would be highly advantageous to be able to alter quickly the feed of a lathe tool by a simple contrivance, especially in lathes whose screw serves the purpose of tool feeding as well as screw cutting. A moderate range of tool feed is, however, obtained in lathes having an independent tool feed by simply shifting the belt on the cone which drives the tool feed spindle. We are not prepared from your description to speak decisively of your arrangement, but should judge that a wide range of alteration in tool travel could be easily obtained by it.

M. A. G., in answer to several inquiries about keeping water pure in cisterns: Wooden or other cisterns constructed to receive rain water from the roof of buildings, as generally made, soon become foul, with sediment, smoke, and other impurities from the roof. In a short time the water becomes stagnant, and unpleasantly odorous. To remedy this, carry the pipe which brings the water into the cistern to within two or three inches of the bottom, thus discharging the fresh water at the bottom, and causing an entire change of water every time it rains. Then there ought to be an opening or valve of some sort at the bottom, by which you can drain out all the contents, and thoroughly rinse and scrub the inside as occasion may require. An auger hole and plug so placed as to be easily accessible would answer the purpose. Such a cistern placed under a woodhouse, or in some secure place out of the reach of frost, with the outlets arranged to be reached from the cellar, and discharging the surplus water into the cellar drain, and a pipe to connect with a pump in the kitchen, will be a wonderful convenience in places where soft water is not easily obtained. I constructed one which has proved very satisfactory after six years' use, in the following manner; About four or five feet outside the cellar, and under a wing of the house, I dug down nearly to the depth of the cellar, and of the required size, say six or eight feet. The ground was a very solid clay, except the surface soil of about 18 inches. This upper portion, in the soft soil, we dug larger, perhaps a foot or more all round. In this portion I laid a stone wall in lime mortar, so that the inside was even with the lower portion of the cistern; I then placed a piece of iron pipe from the bottom of the cistern through the earth, into the inside of the cellar, with the end opening over the cellar drain, wedging the pipe in firmly with small stones and cement, and closing the cellar with a wooden plug. I then plastered the entire inner surface of bottom and side (laying a flat stone in the center to stand upon) with the cement called water lime, mixed with sand; putting on two coats and allowing time to dry; afterwards I put on a coat of clear cement very thin, with a brush, to close any little checks caused in drying. The house was then built over it. The rooms were warm and frost never troubled, and through a man hole in the floor we could go down, and with a broom thoroughly clean the inside, thus at all times having a full supply of water for all household purposes. To illustrate the importance of conveying the incoming water to the bottom, spoken of above, I note the case of a glass aquarium with a fountain in the center, which, though supplied with running water through the fountain, in a few weeks became offensive in odor, and the fish died. We then had a pipe put on conveying a portion of the water into the aquarium at the bottom, which did not interfere with the appearance or efficiency of the fountain, but caused a continuous change of water; and we had no further trouble.

D. says: In answer to several of your correspondents who wish to know how to make rubber hand stamps: Vulcanized rubber used, as prepared by the manufacturers, and can be procured in strips about 3 inches wide and about ⅛ of an inch thick, and of any desired length. The name and address should be set up in common printing type, and the type well oiled; a rim about ¼ inch in hight should be placed around the form, and dentist's splaster, mixed to the proper consistence, poured in and allowed to set; then the plaster cast is separated from the type. A piece of the soft vulcanized rubber is then cut of the size of the plaster mold and laid upon it, and both together are placed in a screw press, and heat sufficient to thoroughly soften the rubber is applied. The screw is then turned down hard and left for a short time until the rubber is perfectly forced into the mold. After the whole is cold, the rubber is separated from the model, and any irregularities trimmed off with a sharp knife; the rubber stereotype is then fastened, with glue or other cement, to a block of wood, and the stamp is ready for use.

H. R. C. sends a description of an improvement upon a leg supporter: On p. 250 of your vol. 30, in answer to "Sufferer," Dr. Chapman, of New Haven, Conn., says: A stiff and straight iron rod, flattened at each end and padded, of the length of the leg, is fastened to the outside of the leg." Now it seems to me this arrangement would be uncomfortable to wear, inasmuch as it does not allow of a free use of the knee joint. I have made a support for a number of parties which works admirably. The support is made entirely of steel except the heel covering, which is made of brass fitted to the heel. The bands placed behind the limb are three in number, covered with calfskin, and lined over a padding of thick beaver cloth with soft sheepskin. These three pieces are stitched together and extended far enough to go around the leg, where they are fastened by metal strips which button on small steel knobs.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined with the results stated:

H. W. S.—We are unable to decide what the plant is, from the flower. To analyze a plant, we must have stem, leaf, and flower, and sometimes it is necessary to have the roots also. There is no plant, to our knowledge, that is called the Thousand Dollar Plant, either in this country or in Europe. It is doubtful if the plant growing so abundantly in Texas would grow in the colder climate of Germany.—A. J. H.—It is a specimen of iron ore, containing a large percentage of silica.

J. M. K. asks; Can you tell me of the best treatment for asthma by inhalation?—A. M. G. asks: Can you give me a recipe for cleaning an oil painting from particles of paper, etc., that are stuck to it?—L. H. R. asks: What size should I make the steamports of a cylinder 13¼ inches diameter x 1¾ inches stroke, to be driven at as high a rate of speed as possible, by an upright cylindrical boiler without any flues (10 inches in diameter x 12 inches high), capable of carrying 30 or 40 lbs. steam?—J. E. W. says: I have a great deal of trouble in obtaining a good light upon my work when engraving on bright surfaces. The reflections are so great at times as to render it difficult to follow the tracings with the graver. I have used shades of various kinds, but find no relief. What will remedy the difficulty?—A. C. F. asks: 1. With what can I size some fancy paper articles for varnishing, the paste of which would be dissolved by the common size? 2. What varnish is best for such articles? It should be nearly transparent, and not readily soluble.—S. M. T. asks: Who made the first cast iron plows used in America, and in what year were they made?—G. W. asks: What kind of varnish would be the cheapest, besides possessing strong adhesive and entirely waterproof qualities, with which to coat paper and not penetrate said paper but very slightly?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On the Tides of Lakes. By L. L.
On a Mercurial Telescope. By H. S.
On Car Ventilation. By S.
On a Chemical Coquette. By S. H. T.
On Worn Out Clay Soils. By G. V.
On the Influence of the Pole Star. By P. H.
On the Alcohol Question. By Z. C. W.

Also enquiries and answers from the following:

C. M. D.—G. W. W.—H. C. A.—S. H.—L. C. J.—R. H. N. J. O. R.—B. G.—A. H. F.—C. I. A.—H. R. C.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of enquiries analogous to the following are sent: "Please to inform me where I can buy sheet lead, and the price? Where can I purchase a good brick machine? Whose steam engine and boiler would you recommend? Which churn is considered the best? Who makes the best mucilage? Where can I buy the best style of windmills?" All such personal enquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED IN THE WEEK ENDING

August 4, 1874,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

30,633.—FIRE ESCAPE.—E. B. Larchar. Oct. 28.
30,745.—CULTIVATOR.—N. Messenger. Nov. 11.

EXTENSIONS GRANTED.

29,490.—MILL.—C. B. Hutchinson.
29,500.—BLANK ROLLING MACHINE.—N. C. Lewis.
29,502.—PIANOFORTE.—H. Lindeman.
29,510.—CAR FLOOR, ETC.—R. Montgomery.
29,523.—CAMERA.—A. Semmendinger.
29,534.—LATHE.—B. D. Whitney.
29,551, 29,562.—BOOTS AND SHOES.—L. R. Blake.
29,576.—ENGINE PISTON.—H. D. Dunbar.
29,579.—ENGINE GOVERNOR.—R. W. Gardner.
29,593, 29,594.—REAPER AND MOWER.—A. A. Henderson.
29,648.—SEWING MACHINE NEEDLE.—F. H. Drake.

DISCLAIMER.

29,579.—ENGINE GOVERNOR.—R. W. Gardner.

DESIGNS PATENTED.

7,602.—HEATER.—J. Benner, Philadelphia, Pa.
7,603.—CALENDAR.—W. A. Emerson, Providence, R. I.
7,604.—VASE.—J. W. Fiske, New York city.
7,605.—PEDESTAL.—J. W. Fiske, New York city.
7,606.—BOTTLE.—A. Gruning, New York city.
7,607.—COOK STOVE.—C. Noble, Philadelphia, Pa.

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7,608.—CARPET.—C. A. Righter, Philadelphia, Pa.
7,609 to 7,616.—OIL CLOTHS.—J. Hutchison, Newark, N.J.
7,617 to 7,621.—CARPETS.—C. T. Meyer *et al.*
7,622 to 7,621.—BORDERS.—C. Osborne, N. Attleborough, Mass.
7,625.—OIL CLOTH.—J. B. Virolet, Paris, France.
7,626.—FURNITURE LEGS.—F. Robertson, New York city.

TRADE MARKS REGISTERED.

1,911.—YEAST POWDER.—A. G. Dooley, New York city.
1,912.—RUM.—L. H. Felton, Boston, Mass.
1,913.—BUTTONS.—Newell Bros. Co., Springfield, Mass.
1,914.—INKSTANDS.—A. Teyssonnier, Paris, France.
1,915.—MEAT EXTRACT.—San Antonio M. E. Factory, Tex.
1,916.—SILK GOODS.—E. Warburg & Co., New York city.
1,917.—CHEWING TOBACCO.—Beck *et al.*, Chicago, Ill.
1,918.—GLUE, ETC.—Champion Glue Co., Chicago, Ill.
1,919 & 1,920.—SOAP., ETC.—Colgate & Co., N. Y. city.
1,921 & 1,922.—FELT SKIRTS.—Elliott Mills, Boston, Mass.
1,923.—MEDICINE.—Leath & Ross, London, England.
1,924.—CIGARS, ETC.—Consolidated Tobacco Co., Gilroy, Cal.

SCHEDULE OF PATENT FEES.

On each Caveat	$10
On each Trade Mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On application for Design (7 years)	$15
On application for Design (14 years)	$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA AUGUST 3, 1874.

3,720.—T. Y. Cassiano, San Antonio, Bexar county, Tex., U. S. Improvements on hats, cal ed "Cassiano's Improved Hat." Aug. 3, 1874.
3,721.—P. F. King, G. N. Beard, and E. J. Beard, St. Louis, Mo., U. S. Improvements on nut locks, called "King Excelsior Nut Lock." Aug. 3, 1874.
3,722.—G. P. Draper, Rochester, N. Y., U. S. Improvement on sewing machine tables, called "Draper's Sewing Machine Table." Aug. 3, 1874.
3,723.—L. Draper, North Attleborough, Mass., U. S. Improvement on currycombs, called "Draper's Self-Cleaning Currycomb." Aug. 3, 1874.
3,724.—C. Callahan and E. E. Sibley, Chelsea, Mass., U. S. Improvements on knitting machines, called "Callahan's Knitting Machines." Aug. 3, 1874.
725.—R. C. Cuff, Hamilton, Ont. Machine for mincing meat, called "Cuff's Meat Mincing Machine." Aug. 3, 1874.
726.—A. H. Wagner, Windsor, Ont. Improvements on pitchers or vessels for containing thick or cohesive liquids, called "Wagner's Double Lipped Pitcher." Aug. 3, 1874.
3,727.—A. Harvey, Toronto, Ont. Improvements on the mode of applying for insurances and of writing or printing and issuing policies therefor, called "Harvey's Insurance System." Aug. 3, 1874.
3,728. J. W. Cuthbertson, Brantford, Ont. Improvements on frames for window screens, called "Cuthbertson's Improved Window Screen." Aug. 3, 1874.
3,729.—W. J. Burleigh, Rome, N. Y., U. S. Improvements on the manufacture of starch polish, called "Burleigh's Starch Polish." Aug. 3, 1874.
3,730.—T. Young, Montreal, P. Q. Improvements on a cooking stove, called "The Mechanic." Aug. 3, 1874.
3,731.—J. E. Cisco, Conneautville, Pa., U. S. Improvements on car couplings, called "Cisco's Car Coupling." Aug. 3, 1874.
3,732.—A. A. Griffing, Jersey City, N. J., U. S. Improvements on steam radiator, called "Griffing's Radiator." Aug. 3, 1874.
3,733.—W. Thilmany, Cleveland, O., U. S. Improvements on the art or process of treating textile fabrics to prevent mildew and decay, called "Thilmany's Process of Treating Textile Fabrics to Prevent Mildew and Decay." Aug. 3, 1874.
3,734.—S. C. Hendrickson, Brooklyn, N. Y., U. S. Improvements on electric railway signaling apparatus, called "Hendrickson's Electric Railway Signal." Aug. 3, 1874.

Advertisements.

Back Page - - - - - - - $1.00 a line.
Inside Page - - - - - - - 75 cents a line.

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

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Manufacturers of and Dealers in
ALL KINDS OF HARD WOODS, IN LOGS, PLANK, BOARDS, & VENEERS,
186 to 200 Lewis St., Foot 5th & 6th Sts., East River, New York.
Attention is especially invited to our Stock of French Walnut and Ash Burls, Birds-Eye and Curly Maple, Satin Wood, Tulip, Rosewood, and Hungarian Ash. Also, Seasoned Mahogany, Walnut, Spanish and Red Cedar, and White Holly.
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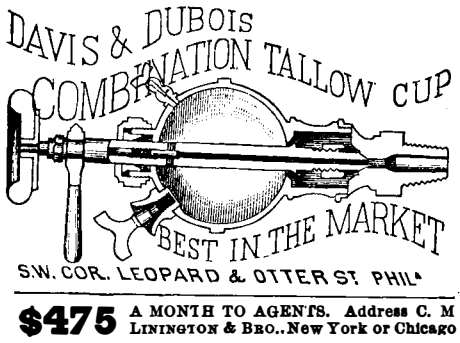
PATENTS Sold and Introduced. F. T. H. RAMSDEN, Bryan Block, Chicago, Ill. Mechanical Engineer and Manufacturers' Agent.



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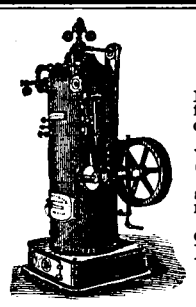
MACHINERY, NEW and 2d-HAND,—Send for Circular. CHAS. PLACE & CO. 60 Vesey st., New York.



THE TRADE ENGINE.

Noiseless in operation—Perfect in workmanship—all light parts of Cast Steel.
Every Engine indicated, and valve corrected to give the highest attainable results.
Warranted superior to any semi-portable Engine in the market.
Send for Price List and Circular.
HERRMAN & HERCHELRODE M'F'G CO., Dayton, Ohio.

ADVERTISERS! Send twenty-five cents to GEO. P. ROWELL & CO., 41 Park Row, New York, for their *Pamphlet of one hundred pages*, containing lists of 3,000 newspapers, and estimates showing cost of advertising.

MAGNETS—Permanent Steel Magnets of any form or size, made to order by F. C. BEACH & CO., 263 Broadway, New York. Makers of the celebrated Tom Thumb and Miniature Telegraph Instruments.

SAMPLES OF MACHINES, TOOLS, and IMPLEMENTS, received, exhibited, and orders taken. A. M. PAXTON & CO., Vicksburg, Miss.

$2400 Yearly to Agents. 56 new articles and the best Family Paper in America, with two $5 Chromos. Family Journal, 369 Br'way, N. Y.

The Toll-Gate! Prize Picture sent free! An ingenious gem! 50 objects to find! Address. with stamp, E. C. ABBEY, Buffalo, N.Y.

PATENT
Planing and Matching
and Molding Machines, Gray & Wood's Planers, Self-oiling Saw Arbors, and other wood working machinery.
S. A. WOODS MACHINE CO., 91 Liberty st., N. Y.; 67 Sudbury st. Boston
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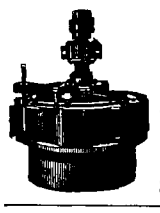

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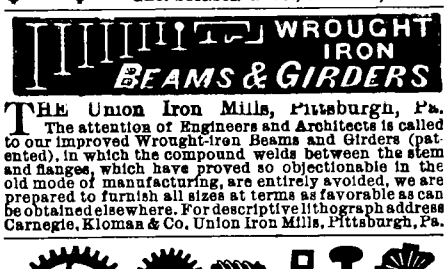

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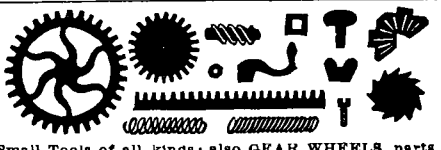

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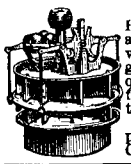

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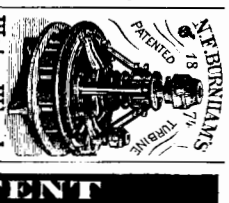

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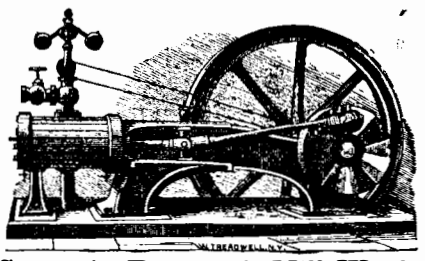

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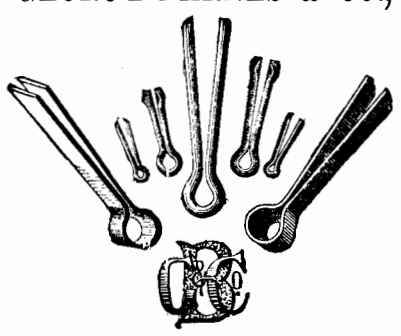

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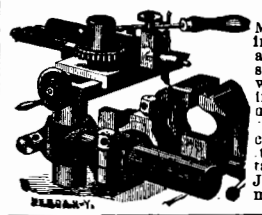

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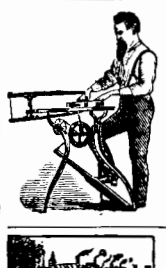

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